London Borough of Richmond upon Thames
Air Quality Annual Status Report for 2024
Date of publication: 30th May 2025

This report provides a detailed overview of air quality in the London Borough of Richmond upon Thames during 2024. It has been produced to meet the requirements of the London Local Air Quality Management (LLAQM) statutory process[1].

[1] LLAQM Policy and Technical Guidance 2019 (LLAQM.TG(19))

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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, delivering the co-benefits to Climate Change and informing the public. This 2025 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 Air Quality Management Area (AQMA) across the whole Borough for nitrogen dioxide and particulatess (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. 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

Abbreviation	Description
AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQN	Air Quality Neutral
AQO	Air Quality Objective
AQP	Air Quality Positive
BEB	Buildings Emission Benchmark
CAB	Cleaner Air Borough
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

Table A. Summary of National Air Quality and International Standards, Objectives and Guidelines

Pollutant	Standard / Objective / Guideline	Averaging Period	Date[1]
Nitrogen dioxide (NO_2)	200 µg m^{-3} not to be exceeded more than 18 times a year	1-hour mean	31 Dec 2005
Nitrogen dioxide (NO_2)	40 µg m^{-3}	Annual mean	31 Dec 2005
Nitrogen dioxide (NO_2)	WHO AQG[2]: 10 µg m^{-3}	Annual mean	
Particles (PM_{10})	50 µg m^{-3} not to be exceeded more than 35 times a year	24-hour mean	31 Dec 2004
Particles (PM_{10})	WHO AQG[2]: 45 µg m^{-3} not to be exceeded more than 3-4 times a year	24-hour mean	
Particles (PM_{10})	40 µg m^{-3}	Annual mean	31 Dec 2004
Particles (PM_{10})	WHO AQG[2]: 15 µg m^{-3}	Annual mean	
Particles ($PM_{2.5}$)	20 µg m^{-3}	Annual mean	2020
Particles ($PM_{2.5}$)	London Mayoral Objective[3]: 10 µg m^{-3}	Annual mean	2030
Particles ($PM_{2.5}$)	WHO AQG[2]: 5 µg m^{-3}	Annual mean	
Particles ($PM_{2.5}$)	Target of 15% reduction in concentration at urban background locations	3-year mean	Between 2010 and 2021
Particles ($PM_{2.5}$)	WHO AQG[2]: 15 µg m^{-3}	24-hour mean	
Sulphur dioxide (SO_2)	266 µg m^{-3} not to be exceeded more than 35 times a year	15-minute mean	31 Dec 2005
Sulphur dioxide (SO_2)	350 µg m^{-3} not to be exceeded more than 24 times a year	1-hour mean	31 Dec 2004
Sulphur dioxide (SO_2)	125 µg m^{-3} mot to be exceeded more than 3 times a year	24-hour mean	31 Dec 2004
Sulphur dioxide (SO_2)	WHO AQG[2]: 40 µg m^{-3} not to be exceeded more than 3-4 times a year	24-hour mean	

Notes:

(1) Date by which to be achieved by and maintained thereafter

(2) 2021 World Health Organisation Air Quality Guidelines

(3) Environmental Target Regulations under the Environment Act 2021

(4) London Mayoral Objective

1. Air Quality Monitoring

The latest monitoring results for 2024 confirm that air pollution in the London Borough of Richmond upon Thames still exceeds the Government Air Quality objectives at one location. As pollution levels can fluctuate one year to the next, there is still a need for LBRuT to be designated as an AQMA and to pursue improvements in air quality. To clarify, the borough-wide AQMA has declared exceedances of the annual mean objective for NO_2 and for exceedance of the annual and 24-hour mean objectives for PM_{10} (i.e. the AQMA covers both long-term and short-term PM_{10} objectives). LBRUT also recognise the need for stricter objectives following changes to the World Health Organisation Guidelines on key pollutants announced on the 22nd September 2021 and have made a commitment within its new AQAP to achieving the WHO interim guidance levels.

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), therefore these are not included in this report. Please see previous Council reports for further information. The LBRuT have complied with UK 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 real time measurements of pollution levels, but is expensive, so using them for a large coverage of LBRuT would be cost prohibitive.

The sites (see Table B) are also representative of relevant exposure either at the site or very close by. The two Richmond operated sites are reported on the Imperial College London Air Quality Network, as is the site at the National Physical Laboratory (NPL). This site is also part of the government’s UK Automatic Urban and Rural Network (AURN). Unfortunately, in 2024 there appears to be no data for the NPL site from 10 Oct 2023 – 27 Nov 2024, so data for 2024 has been recorded as not available (N/A). This is outside the local authority’s control. If data capture improves for 2025 it will again be included in the 2026 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 four weeks, serviced every six months. More details can be found at https://www.londonair.org.uk/LondonAir/Default.aspx

Table B. Details of Automatic Monitoring Sites for 2024

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA?	Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
RI1	**Castlenau** Library, Barnes	Roadside	522500	177166	$NO_{2,}$, PM_{10}	Yes	LBRuT	Chemiluminescent; TEOM	8.0	3.3	2.4
RI2	**Wetland Centre**, Barnes	Urban Background	522993	176731	$NO_{2,}$, PM_{10}, O_3	Yes	LBRuT	Chemiluminescent; TEOM	10.0	482.52	3.2
TD5	**NPL -** Teddington AURN	Suburban	522993	176731	PM_{10}, $PM_{2.5}$	Yes	LBRuT	FDMS, FIDAS	2.0	13.0	12.0

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable

Table C. Details of Non-Automatic Monitoring Sites for 2024

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m)	Distance to Kerb of Nearest Road (m)	Tube Co-located with a Continuous Analyser	Height (m)
1	Hampton Court Rd, Hampton (nr Bushy Pk gates)	Roadside	515824	168815	NO_2	LBRuT	1.9	1.7	No	2.2
2	Percy Rd, Hampton (nr. level crossing/Waitrose)	Roadside	513217	169746	NO_2	LBRuT	3.0	1.3	No	2.2
4	Hampton Rd, Hampton Hill (nr. Laurel Dene)	Kerbside	514607	171258	NO_2	LBRuT	9.8	0.6	No	2.2
7	Broad St, Teddington (o/s Boots)	Kerbside	515695	170983	NO_2	LBRuT	2.5	0.8	No	2.2
9	Hampton Rd, Twickenham (nr Fifth Cross Rd)	Kerbside	514846	172348	NO_2	LBRuT	2.0	0.6	No	2.2
10	Twickenham Rd, Twickenham (opp. Fulwell golf course)	Kerbside	513390	172233	NO_2	LBRuT	7.2	0.6	No	2.2
11	Percy Rd, Whitton (nr. Percy Way)	Kerbside	514136	173389	NO_2	LBRuT	9.1	0.6	No	2.2
12	Hanworth Rd, Whitton (nr Lyndhurst Ave)	Kerbside	512612	173439	NO_2	LBRuT	7.4	0.6	No	2.2
13	Whitton Rd, Whitton, (opp. rugby ground)	Kerbside	515228	174082	NO_2	LBRuT	6.3	0.8	No	2.2
15	Richmond Rd, Twickenham (opp. Marble Hill Pk)	Kerbside	517196	173933	NO_2	LBRuT	1.8	0.6	No	2.2
17	Red Lion Street, Richmond	Kerbside	517822	174755	NO_2	LBRuT	2.0	1.2	No	2.2
18	Lower Mortlake Rd, Richmond (nr Trinity Rd)	Kerbside	518822	175590	NO_2	LBRuT	9.3	0.9	No	2.2
19	Kew Rd, Kew (nr. Walpole Av)	Kerbside	518643	176156	NO_2	LBRuT	16.0	0.7	No	2.2
20	Mortlake Rd, Kew (nr. Kings Schl)	Kerbside	519205	177221	NO_2	LBRuT	2.8	0.6	No	2.2
22	Castelnau, Barnes (nr. Hammersmith Bridge)	Kerbside	522853	177908	NO_2	LBRuT	4.2	0.5	No	2.2
23(1), 23(2), 23(3)	Castelnau Library, Barnes (static site)	Roadside	522502	177166	NO_2	LBRuT	9.0	3.3	Yes	2.2
26	URRW, Sheen (nr. Courtland Estate)	Roadside	519168	175055	NO_2	LBRuT	11.8	3.2	No	2.2

28	Holly Lodge, Richmond Pk	Urban Background	519445	173991	NO_2	LBRuT	0.0	2175.0	No	2.2
30	Petershan Rd, nr The Russell Schl, TW10	Roadside	518022	173165	NO_2	LBRuT	1.3	1.9	No	2.2
31	A316 (nr. Chudleigh Rd)	Roadside	515434	174045	NO_2	LBRuT	6.4	1.0	No	2.2
32	Kings St, Twickenham (nr Iceland)	Roadside	516226	173195	NO_2	LBRuT	3.8	1.7	No	2.2
33	Heath Rd, Twickenham (nr M&S)	Roadside	515934	173126	NO_2	LBRuT	6.9	3.3	No	2.2
35	High St, Hampton Wick	Roadside	517524	169583	NO_2	LBRuT	1.4	1.3	No	2.2
36	Upper Richmond Road West(URRW), nr j/w Sheen Lane	Roadside	520540	175399	NO_2	LBRuT	2.2	2.1	No	2.2
37(1), 37(2), 37(3)	Wetlands, Barnes (static site)	Urban Background	522993	176731	NO_2	LBRuT	230.0	482.52	Yes	2.2
39	Richmond Rd, nr Lidl, East Twickenham	Roadside	517516	174331	NO_2	LBRuT	2.7	1.2	No	2.2
40	Staines Rd, Twickenham	Kerbside	514068	172435	NO_2	LBRuT	11.4	1.0	No	2.2
42	The Quadrant/Kew Rd, Richmond	Kerbside	518080	175259	NO_2	LBRuT	2.9	0.7	No	2.2
43	Hill St, Richmond	Kerbside	517759	174757	NO_2	LBRuT	1.6	0.7	No	2.2
44	Sheen Rd, Richmond (near shops)	Kerbside	518489	175056	NO_2	LBRuT	0.5	0.5	No	2.2
45	High St, Teddington, (nr Cook)	Kerbside	516383	171154	NO_2	LBRuT	3.3	0.5	No	2.2
50	URRW, nr. Clifford Av, Sheen	Kerbside	519922	175324	NO_2	LBRuT	2.7	0.7	No	2.2
51	Sheen Lane, Sheen (nr Thomson Hse Schl)	Roadside	520492	175695	NO_2	LBRuT	2.0	2.0	No	2.2
52	Clifford Av, nr Chalkers Corner	Roadside	519773	175795	NO_2	LBRuT	2.1	2.0	No	2.2
55	Mortlake Road, adj Cemetery Gates,	Kerbside	519793	176142	NO_2	LBRuT	4.1	0.6	No	2.2
56	A316 (St Magarets, nr Cassillis Rd)	Kerbside	516788	174519	NO_2	LBRuT	9.6	1.0	No	2.2
57	A316 (nr Lincoln Avenue)	Kerbside	513915	172899	NO_2	LBRuT	16.4	1.0	No	2.2
58	London Road, Twickenham(nr Twickenham bridge)	Kerbside	516039	173766	NO_2	LBRuT	6.4	0.7	No	2.2
62	High Street, Barnes (nr Cook)	Kerbside	521651	176430	NO_2	LBRuT	2.3	0.4	No	2.2
63	High Street, Whitton (nr Tescos)	Kerbside	514188	173801	NO_2	LBRuT	3.2	0.8	No	2.2

64	High Street, Hampton Hill (nr Tescos)	Kerbside	514484	171251	NO_2	LBRuT	1.6	0.5	No	2.2
65	York Street, Twickenham	Kerbside	516339	173366	NO_2	LBRuT	2.7	0.5	No	2.2
66	South Circular, Kew Green	Kerbside	519060	177428	NO_2	LBRuT	3.3	2.1	No	2.2
67	Petersham Rd opp Poppy Factory,	Roadside	518042	174095	NO_2	LBRuT	2.7	1.4	No	2.2
68	Rocks Lane, SW13.	Roadside	522415	176537	NO_2	LBRuT	3.2	3.8	No	2.2
69	Uxbridge Rd, nr Longford Cl TW12	Roadside	513494	171729	NO_2	LBRuT	2.9	2.0	No	2.5
70	Stag Brewery, Lwr Richmond Rd	Roadside	520465	175965	NO_2	LBRuT	2.1	1.8	No	2.5
71	A316, nr St Stephens Primary	Roadside	516574	174456	NO_2	LBRuT	9.9	2.9	No	2.2
72	St Margarets Rd, St Margarets (nr. Crown Rd)	Kerbside	516839	174238	NO_2	LBRuT	2.5	0.8	No	2.2
73	Hospital Bridge Rd, nr Homelink	Roadside	513722	172873	NO_2	LBRuT	8.4	2.1	No	2.4
74	Lower Richmond Rd, Mortlake (nr. Chalker's Corner)	Roadside	519856	175856	NO_2	LBRuT	5.9	2.6	No	2.3
75	Hampton Rd (opp Tedd Mem Hosp)	Kerbside	515459	171029	NO_2	LBRuT	6.3	0.6	No	2.2
76	Manor Rd, nr Ferry Rd, TW11	Kerbside	516588	171357	NO_2	LBRuT	3.3	0.4	No	2.2
77	Sixth Cross Rd, nr Wellington Rd,TW2	Roadside	514705	172092	NO_2	LBRuT	4.5	0.6	No	2.2
79	South St, outside Lidl, TW2 5NJ	Kerbside	514810	172041	NO_2	LBRuT	6.6	1.0	No	2.3
80	Mortlake High St, SW14	Kerbside	520538	175926	NO_2	LBRuT	2.6	0.8	No	2.2
81	Chertsey Ct (A316),	Roadside	519912	175939	NO_2	LBRuT	9.2	1.6	No	2.4
82	Twickenham station development	Roadside	516060	173708	NO_2	LBRuT	4.8	2.5	No	2.4
83	Thames St, Hampton, nr Plevna Rd, TW12	Kerbside	513811	169510	NO_2	LBRuT	0.9	0.3	No	2.6
84	Queens Rd,Richmond (nr Christs School)	Roadside	513872	169518	NO_2	LBRuT	5.2	1.7	No	2.5
85	Richmond bus garage	Roadside	517911	174737	NO_2	LBRuT	8.4	1.7	No	2.5
87	A316, nr Larkfield Rd,Richmond	Roadside	518280	175367	NO_2	LBRuT	0.7	5.8	No	2.5
Rut 01	Civic Centre, York St, Twickenham	Roadside	516415	173419	NO_2	LBRuT	3.0	2.9	No	2.5
Rut 02	George Street, Richmond	Kerbside	517917	174928	NO_2	LBRuT	2.2	0.7	No	3.5

105	outside East Sheen Primary School, URRW, SW14	Roadside	521315	175461	NO_2	LBRuT	4.8	2.5	No	2.2
211	Park Rd, Hampton Hill, LC 002 (nr 6 Park Rd)	Roadside	514476	171310	NO_2	LBRuT	1.8	0.7	No	2.2
RP11	LC 189 Hmpt Ct Rd (nr Kingston)	Roadside	517456	169342	NO_2	LBRuT	1.6	0.9	No	2.3
RP12	LC 054 A308 nr Thames Motor Yacht	Roadside	515371	168705	NO_2	LBRuT	2.4	0.8	No	2.3

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property).

(2) N/A if not applicable.

1.2 Comparison of Monitoring Results with AQOs

Table D. Annual Mean NO_2 Monitoring Results: Automatic Monitoring (µg m^{-3})

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site type	Valid data capture for monitoring period %([b])	Valid data capture 2024 %[(b)]	2018	2019	2020	2021	2022	2023	2024
Castelnau Library, Barnes (RI1)	522500	177166	Automatic roadside	100%	100%	31	27	20	21	23	16	19.2
Wetlands Centre, Barnes (RI2)	522993	176731	Automatic Suburban	100%	86%	20	21	15	14	14	14	12.3

Notes:

The annual mean concentrations are presented as µg m^{-3}.

Exceedances of the NO_2 annual mean AQO of 40 µg m^{-3} are shown in **bold**.

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**.

Means for diffusion tubes have been corrected for bias.

All means have been "annualised" in accordance with LLAQM Technical Guidance if valid data capture for the calendar year is less than 75% and greater than 25%.

Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

(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%).

All data has been properly ratified by Imperial College London

Table D provides the 2024 results of the NO_2 automatic monitoring and a comparison with the annual mean objective.

As mentioned in section 1, NO_2 is a specified pollutant for the whole Borough AQMA. The findings from this report indicate that the AQMA should be maintained.

The 2024 NO_2 data capture rate for RI1 Castelnau was excellent at 100% and for RI2 Wetlands was good at 86%, both above the 75% data capture rate required by Defra. This means neither require annualisation. Both have been properly ratified by Imperial College London.

The 2024 results indicate that both sites met the objective of 40 µg m^{-3}. The 2024 raw annual mean for the RI2 (Wetlands) was 12.3 µg m^{-3} indicating a reduction of around 1.7 µg m^{-3} following three years of virtually no change from the 14 µg m^{-3} measured in 2021, 2022 and 2023. This site is a background site far from the main road and close to the River Thames and therefore representative of low pollution in the Borough. Whilst this is welcome news, levels of NO_2 may go up or down slightly in future years,so we need to keep a close eye on results. It also demonstrates the real challenges of achieving 10 µg m^{-3} borough wide in line with 2021 WHO guidelines. It is also important to note that with lower levels of NO_2, local projects such as road closures and roadwork construction may contribute to fluctuations in pollution levels within the borough.

The annual mean at the RI1 (Castelnau) roadside site was 19.2 µg m^{-3} an increase of around 3.2 µg m^{-3} from 2023 (16 µg m^{-3}) but a decrease of around 3.8 µg m^{-3} from 2022 (23 µg m^{-3}). This appears less encouraging but does demonstrate how air quality levels

can go up and down slightly year on year but also demonstrates that the general trend is downwards. It must be remembered that Castelnau Air Quality station, although a roadside site, is not currently representative of typical roadside concentrations for LBRUT. This is because Hammersmith Bridge at the end of Castelnau was closed to all vehicles on 10th April 2019 for safety reasons until strengthening work was completed. From May 2016 buses were restricted and a weight restriction of 7.5 tonnes was placed on the bridge preventing many HGVs from crossing. Data from 2016 - 2024 reflects this, indicating more significant reductions than may otherwise be expected. Following extensive engineering work, Hammersmith bridge re-opened to pedestrians, cyclists e-scooters, and other forms of pedalled transport in April 2025. The bridge now has dedicated cycle lanes and a wider pedestrian path. Whether or not it will ever re-open to vehicles and if so, which type is currently unknown.

Consideration has been given to relocating the site. On balance, following discussions with the Council and Imperial College London, for data continuity and trend data purposes, it has been decided to leave it in situ. This will be reviewed annually.

In February 2025 a new roadside automatic monitoring site for Richmond town centre, representative of more typical/worst case scenario roadside emissions, was installed. Results will be reported in our 2026 Annual Status Report.

Table E. Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg m^{-3})

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%)	Valid Data Capture 2024 (%)	2018	2019	2020	2021	2022	2023	2024
1	515824	168815	Roadside	100	100.0	**41.0**	35.0	25.0	26.0	22.0	19.6	16.1
2	513217	169746	Roadside	100	100.0	32.0	29.0	21.0	24.0	21.0	18.6	16.5
4	514607	171258	Kerbside	100	100.0	35.0	31.0	27.0	28.0	24.0	22.5	21.1
7	515695	170983	Kerbside	100	100.0	**45.0**	39.0	34.0	37.0	26.0	25.5	26.4
9	514846	172348	Kerbside	100	100.0	**40.0**	35.0	31.0	31.0	23.0	20.9	17.7
10	513390	172233	Kerbside	100	100.0	**41.0**	**40.0**	33.0	33.0	26.0	24.5	24.2
11	514136	173389	Kerbside	100	100.0	**46.0**	34.0	27.0	27.0	24.0	22.8	19.8
12	512612	173439	Kerbside	100	100.0	**44.0**	**40.0**	31.0	30.0	26.0	23.2	20.7
13	515228	174082	Kerbside	100	100.0	**40.0**	39.0	36.0	30.0	24.0	21.0	18.6
15	517196	173933	Kerbside	100	100.0	34.0	32.0	26.0	26.0	21.0	19.6	19.1
17	517822	174755	Kerbside	100	100.0	**54.0**	**50.0**	**40.0**	**46.0**	31.0	26.8	24.9
18	518822	175590	Kerbside	100	92.5	**46.0**	**46.0**	**41.0**	39.0	30.0	30.0	27.6
19	518643	176156	Kerbside	100	100.0	**42.0**	37.0	30.0	28.0	21.0	22.5	19.9
20	519205	177221	Kerbside	100	100.0	38.0	38.0	30.0	28.0	32.0	30.2	25.0
22	522853	177908	Kerbside	100	100.0	**45.0**	32.0	21.0	22.0	17.0	17.1	15.2
23(1), 23(2), 23(3)	522502	177166	Roadside	100	100.0	31.0	26.0	20.0	21.0	17.0	16.4	15.5
26	519168	175055	Roadside	100	100.0	36.0	34.0	32.0	33.0	28.0	27.5	26.4
28	519445	173991	Urban Background	100	84.9	18.0	17.0	12.0	12.0	11.0	11.0	9.7
30	518022	173165	Roadside	100	100.0	Not open	Not open	Not open	25.0	20.0	18.8	16.7

31	515434	174045	Roadside	100	100.0	**49.0**	**45.0**	35.0	35.0	31.0	30.8	27.4
32	516226	173195	Roadside	100	100.0	**56.0**	**47.0**	**40.0**	**40.0**	31.0	29.7	26.6
33	515934	173126	Roadside	100	100.0	**52.0**	**40.0**	34.0	39.0	28.0	26.8	24.6
35	517524	169583	Roadside	100	100.0	**42.0**	36.0	32.0	30.0	25.0	22.3	19.5
36	520540	175399	Roadside	100	90.6	**63.0**	**61.0**	**56.0**	**55.0**	**52.0**	**48.3**	**45.3**
37(1), 37(2), 37(3)	522993	176731	Urban Background	100	100.0	21.0	20.0	14.0	14.0	14.0	13.4	11.7
39	517516	174331	Roadside	100	100.0	**45.0**	39.0	32.0	32.0	30.0	31.6	29.7
40	514068	172435	Kerbside	100	100.0	**41.0**	35.0	29.0	29.0	24.0	23.0	19.8
42	518080	175259	Kerbside	100	100.0	**72.0**	**62.0**	**60.0**	**54.0**	**41.0**	37.8	36.6
43	517759	174757	Kerbside	100	100.0	**59.0**	**46.0**	**41.0**	**43.0**	39.0	36.4	34.0
44	518489	175056	Kerbside	100	100.0	**40.0**	37.0	33.0	32.0	29.0	28.6	26.5
45	516383	171154	Kerbside	100	100.0	33.0	32.0	26.0	26.0	20.0	20.0	17.1
50	519922	175324	Kerbside	100	100.0	**52.0**	**50.0**	**45.0**	**46.0**	39.0	38.2	33.9
51	520492	175695	Roadside	100	100.0	33.0	30.0	24.0	23.0	19.0	19.4	18.3
52	519773	175795	Roadside	100	92.5	**59.0**	**55.0**	**46.0**	**45.0**	39.0	36.4	32.2
55	519793	176142	Kerbside	100	100.0	**41.0**	**40.0**	33.0	29.0	26.0	25.6	21.2
56	516788	174519	Kerbside	100	92.5	**43.0**	39.0	31.0	29.0	23.0	20.6	18.7
57	513915	172899	Kerbside	100	90.6	**43.0**	37.0	29.0	29.0	23.0	23.2	19.9
58	516039	173766	Kerbside	100	100.0	**43.0**	**40.0**	33.0	31.0	25.0	21.9	19.7
62	521651	176430	Kerbside	100	100.0	**43.0**	**43.0**	32.0	32.0	25.0	24.2	21.3
63	514188	173801	Kerbside	100	100.0	38.0	33.0	27.0	27.0	30.0	24.7	21.4
64	514484	171251	Kerbside	100	100.0	**45.0**	**41.0**	34.0	35.0	30.0	27.6	23.1
65	516339	173366	Kerbside	100	100.0	**55.0**	**50.0**	**40.0**	**40.0**	33.0	30.2	30.5
66	519060	177428	Kerbside	100	100.0	**42.0**	**40.0**	32.0	30.0	27.0	24.9	23.6

67	518042	174095	Roadside	100	100.0	**41.0**	32.0	23.0	23.0	21.0	20.4	17.2
68	522415	176537	Roadside	100	100.0	**55.0**	**40.0**	31.0	30.0	25.0	23.6	22.3
69	513494	171729	Roadside	100	100.0	38.0	31.0	22.0	23.0	20.0	19.5	17.2
70	520465	175965	Roadside	100	100.0	Not open	**42.0**	33.0	34.0	27.0	30.2	26.6
71	516574	174456	Roadside	100	90.6	Not open	**52.0**	**43.0**	39.0	34.0	33.0	28.3
72	516839	174238	Kerbside	100	100.0	Not open	**42.0**	33.0	30.0	26.0	23.3	20.6
73	513722	172873	Roadside	100	100.0	Not open	**43.0**	36.0	34.0	28.0	26.8	23.4
74	519856	175856	Roadside	100	100.0	**50.0**	**52.0**	**43.0**	**44.0**	32.0	31.1	28.3
75	515459	171029	Kerbside	100	100.0	Not open	Not open	29.0	29.0	25.0	25.3	23.0
76	516588	171357	Kerbside	100	100.0	Not open	Not open	35.0	35.0	30.0	23.1	21.6
77	514705	172092	Roadside	100	100.0	Not open	Not open	38.0	37.0	31.0	27.2	23.5
79	514810	172041	Kerbside	100	100.0	Not open	Not open	33.0	32.0	25.0	23.2	21.4
80	520538	175926	Kerbside	100	100.0	Not open	Not open	Not open	30.0	24.0	23.2	20.3
81	519912	175939	Roadside	100	100.0	Not open	Not open	Not open	30.0	32.0	32.0	29.0
82	516060	173708	Roadside	100	100.0	Not open	Not open	Not open	Not open	21.0	19.9	17.9
83	513811	169510	Kerbside	100	100.0	Not open	Not open	Not open	Not open	30.0	27.6	23.1
84	513872	169518	Roadside	100	100.0	Not open	Not open	Not open	Not open	Not open	16.0	14.0
85	517911	174737	Roadside	100	100.0	Not open	Not open	Not open	Not open	Not open	39.5	35.8
87	518280	175367	Roadside	100	100.0	Not open	Not open	Not open	Not open	Not open	Not open	33.7
Rut 01	516415	173419	Roadside	100	100.0	38.0	36.0	29.0	27.0	24.0	23.0	21.4
Rut 02	517917	174928	Kerbside	100	100.0	**82.0**	**72.0**	**63.0**	**52.0**	**43.0**	**40.0**	36.0
105	521315	175461	Roadside	100	100.0	Not open	**47.4**	**40.0**	38.5	38.5	33.1	30.8
211	514476	171310	Roadside	100	100.0	Not open	Not open	Not open	31.7	29.3	27.8	24.8
RP11	517456	169342	Roadside	100	100.0	Not open	Not open	Not open	**40.2**	36.4	30.7	26.7
RP12	515371	168705	Roadside	100	90.6	Not open	Not open	Not open	39.7	37.2	31.6	28.4

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LLAQM.TG19 (not required).**

☒ **Diffusion tube data has been bias adjusted.**

☒ **Reported concentrations are those at the location of the monitoring site (bias adjusted and annualised, as required), i.e. prior to any fall-off with distance correction.**

Notes:

The annual mean concentrations are presented as µg m^{-3}.

Exceedances of the NO_2 annual mean objective of 40 µg m^{-3} are shown in **bold and orange**.

NO_2 annual means exceeding 60 µg m^{-3}, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold, red and underlined**.

Sites that comply with the NO_2 annual mean objective of 40 µg m^{-3} are shown in **green.**

Means for diffusion tubes have been corrected for bias. All means have been "annualised" in accordance with LLAQM Technical Guidance if valid data capture for the calendar year is less than 75% and greater than 25%. For 2024 this was not required at any site in LBRuT.

Concentrations are those at the location of monitoring and not those following any fall-off with distance adjustment.

(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(2) Data capture for the full calendar year (e.g. if monitoring was carried out for 6 months, the maximum data capture for the full calendar year is 50%).

Maximum data capture for the monitoring period, for all diffusion tube sites was a full 12 months – 100%. Missing tubes resulted in slightly reduced data capture at individual sites.

The bias adjustment factor used for **all** sites is **0.88** calculated using **the national 50% TEA/acetone Gradko bias adjustment** factor. After careful consideration this was considered the most reliable option for 2024 and in line with partner boroughs. Please see Appendix A Details of Monitoring Site Quality QA/QC A.2 Diffusion tubes - Discussion of Choice of Factor to Use and Appendix E for more information.

Please see Appendix B for full monthly data for 2024, including distance corrected, where relevant.

Notes on sites:

From 4/1/24 site 54 was closed (readings very similar to 55, close by on the A205), and **site 25 was closed** (very similar to 105, close by on the A205); **Site 87** on A316 near Richmond Circus **was opened** to aid Richmond town centre study.

For 2024 it has also been decided to include 4 sites within the above permanent sites, all have been monitored for several years for separate studies. These are **site 105** included in East Sheen Primary School on URRW outside the school, **site 211** Park Rd, Hampton Hill, nr j/w High St, and 2 x sites which were part of the Royal Parks Movement Strategy, including likely displacement traffic - **site RP11** on Hampton Ct Rd near Kingston bridge and site **RP12** on A308 near Thames Motor Yacht and Hampton Court bridge. To avoid confusion and for greater transparency it has been decided to **retain original site ID's.**

From 3/1/23 site 27 was closed. This site was moved further down the road to the next school, renamed site 84 and site 85 was opened. Site 51 on Sheen Lane, moved back to o/s Thomson House School, co-located with new BL node.

From 5/1/22 site 29 was closed and site 81 was made permanent (opened 5/1/21); site 63 moved slightly up Whitton High St on request - site name/number retained; site 61 moved > 20m nearer new Twickenham station development, renamed site 82; site 78(34) moved along A308 >20m on request renamed site 83.

From 5/1/21 site 59 was closed, site 80 was opened. From Aug 2020 air quality mobile was stolen, some data recoverable for 2020, no data for 2021 onwards.

From 6/1/20 sites 14, 24, 41 were closed; sites 75, 76, 77 opened; sites 2, 4, 27 and 29 moved slightly (<20m) to better represent worst-case scenario following requests from residents/officer observation. Site 34 and 48 moved > 20m so for Table P (Non-Automatic Monitoring Data Adjustment) have been renamed site 78 and 79 respectively. Aug 2020 the air quality mobile was stolen – data ceased.

From 9/1/19 sites 6, 16, 47 and 60 were closed; sites 70, 71, 72 and 73 were opened.

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/officer observation and is now close to the junction at Chalker's 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 onwards and 2017 ASR for earlier grid references.

Annual Mean NO2 Monitoring Results: Non-Automatic Monitoring (µg m^{-3}) 2024

Table E shows the NO_2 diffusion tube monitoring results for each year from 2018 to 2024, with bias corrected values, using the national bias adjustment factor of 0.88 for 2024. The data capture for 2024 for all diffusion tube sites was very good (98.9%). No site recorded a data capture of less than 75%, so no annualisation was required for greater accuracy. All sites were monitored for 12 months.

The total number of sites in 2024 where monitoring was undertaken was 68; two of these were triplicates, co-located next to real time automatic analysers. Two sites were background, the remaining 66 were roadside or kerbside.

The results borough wide are encouraging for 2024, continuing the previous years' downward trend in levels of NO_2. It should be noted that The Council's main dilemma when analysing the 2024 data was the choice of the correct bias correction factor to apply. After 4 weeks of careful deliberation and expert discussions, it was decided to use the national 50% TEA/acetone Gradko bias adjustment factor of 0.88, For more information, see Appendix A Details of Monitoring Site Quality QA/QC A.2 Diffusion tubes - Discussion of Choice of Factor to Use and Appendix E.

The 2024 monitoring results show that the Defra objective of 40 µg m^{-3} was exceeded at just 1 site (1.5%) and complied at 67 sites (98.5%). The site that exceeded was site 36 on URRW by the shops, towards the junction with Sheen Lane in East Sheen, which after bias adjustment recorded 45.3 µg m^{-3}. For the first time in the last 22 years, all sites in Richmond town centre complied. After bias adjustment, site 42 opposite Richmond station recorded 36.6 µg m^{-3}, site Rut 2 in George St Richmond 36.0µg m^{-3} and site 85 Richmond bus garage recorded 35.8µg m^{-3}. This means none, after bias adjustment, exceeded the annual mean concentration of 60 µg m^{-3} in 2024 (which indicates it would be likely to exceed the hourly limit value), which is excellent news. These headline figures are very encouraging, but work must continue, to try and maintain and improve upon this position.

For those that complied, 58 sites (85%), measured less than 30 µg m^{-3}, 23 sites (34%) less than 20 µg m^{-3}, and for the first time ever one site (1.5%) less than 10 µg m^{-3}(Richmond Park at 9.7 µg m^{-3}), achieving the WHO guideline set in September 2021. This shows that levels of NO_2 really are coming down. If we compare this to pre-COVID 2018, out of 64 sites, 41 sites (64.1%) exceeded the objective of 40 µg m^{-3} (three also exceeding 60 µg m^{-3}, so likely to exceed the hourly limit value) and only 1 site (1.6%), site 28 in Richmond Park, recorded below 20 µg m^{-3} (18 µg m^{-3}). In terms of overall annual reductions in pollution the borough has seen significant reductions with the trajectory being towards further reductions.

From the 68 monitoring sites in 2024, 65 sites monitored reductions and two sites saw increases. The increases were at site 7 outside Boots in Teddington Broad Street up from 25.5 µg m^{-3} in 2023 to 26.4 µg m^{-3} in 2024 and at site 65 in York Street Twickenham, up slightly from 30.2 µg m^{-3} in 2023 to 30.5 µg m^{-3} in 2024. One new site was opened (site 87).

The sites which witnessed the largest annual reduction of between 4- 5.2 µg m^{-3} for NO_2 were typically sites on TfL controlled roads such as the A316 and the South Circular. Site 20 on the South Circular outside Kings School saw the greatest reduction of 5.2 µg m^{-3} down from 30.2 µg m^{-3} to 25.0 µg m^{-3} from 2023 to 2024, site 50 on URRW near the junction with Cliford Ave (South Circular), site 52 on Clifford Ave (South Circular), site 55 on Mortlake Rd (South Circular), and site 71 outside St Stephens Primary School on the A316 all witnessed reductions of 4.2 - 4.7 µg m^{-3} 2023 to 2024. Site 64 on Hampton Hill High St and site Rut 2 on George St Richmond, both town centre locations, also witnessed reductions of 4.5 µg m^{-3} and 4.0 µg m^{-3} respectively and site 83 on Thames St near Plevna Rd witnessed reductions of 4.5 µg m^{-3}. down from 27.6 µg m^{-3} to 23.1 µg m^{-3} It is encouraging to see useful reductions continue to occur at sites that were already comfortably below 40 µg m^{-3}. It is however true that NO_2 levels on some of these roads are relatively higher so larger reductions will be more likely. . Likewise percentage decreases are likely to increase where actual levels of NO_2 are lower. Overall data indicates that 62 sites recorded reductions of at least 5%, and 38 sites witnessed reductions of more than 10%.

Whilst reductions are welcome, more work is needed. This is because the more we understand about the health effects of air quality, the more we are aware of harm to health that can occur, well below the UK limit value of 40 µg m^{-3}. Richmond Council considers this UK limit value, set by Defra to be achieved by 2005, outdated, so on grounds of harm to health has just adopted an ambitious new level of 20 µg m^{-3} for annual NO_2 throughout the London Borough of Richmond upon Thames in its latest Air Quality Action Plan 2025-30. The GLA is currently consulting on the new London Plan and we hope will do likewise, which would be beneficial for the whole of London. This is in line with new European standards where 20 µg m^{-3} for annual NO_2 has already been adopted.

For the fourth year in the last 22 years of monitoring in the borough, after bias adjustment, no site has exceeded 60 µg m^{-3}, which is very good news and appears set to continue. However, site 36 on Upper Richmond Rd West (South Circular) near Sheen Lane in East Sheen, has for the second year in a row, being the worst polluted location in the borough. Levels have reduced in 2024, as advised above, and after bias adjustment recorded 45.3 µg m^{-3} down from 48.3 µg m^{-3} in 2023. This is now higher than many roads in central London and further improvements are still needed. The extended ULEZ expansion to outer London, which scoped in the South Circular, operational from 29th August 2023, may have helped speed reductions a little here. The incessant problem of slow moving/stop/start motoring, including many HGV's, along this section of the South Circular remains high, partly supplemented by diverted traffic from the closure of Hammersmith Bridge for major repairs. There is no simple solution; closure is likely to remain in place for many years. To a certain extent, this section also suffers from the closure of East Sheen Gate in Richmond Park, diverting traffic onto the South Circular. It is also a busy bus route for buses 33, 337, 493. Electric buses would help. Route 33 was electrified in November 2024, which may be reflected in 2025 data, which will reported in our 2026 report. Further and faster electrification of the remaining TfL bus routes are desirable, which the Council support, encourage and have requested. Any action by TfL to speed up traffic and smooth the flow in this very congested area, lined with narrow pavements, shops and homes would also be welcomed. Such improvements are likely to be challenging especially in the light of the newly approved Stag Brewery development and the redevelopment of Barnes hospital site both of which will bring many more residents, school pupils and visitors to the area in the coming years.

Richmond Council is regularly asked about the effects on air quality from the extension of the ULEZ to outer London. It is difficult to quantify emission reductions solely from the extended ULEZ. Some vehicle upgrades will inevitably result from the central and inner London ULEZ. We know it removed many older more polluting vehicles from the fleet but we are aware and have been reminded by residents that some of these vehicles travelled very few miles weekly or annually, so any emission reduction would be small. The Mayor has issued the **London-wide Ultra Low Emission Zone (ULEZ) One Year Report**, which includes a lot of information

on all aspects of the Lowdon wide ULEZ – LWULEZ. The report advises that the extended ULEZ resulted in an overall 1.4% increase in compliant vehicles seen driving in outer London on an average day up from 95.3% in September 2023 to 96.7% in September 2024. Compliant cars in outer London were up by 1% from 96.4% to 97.4% and vans up by 4.5% from 86.2 to 90.7%. Vans are probably a more important sector since they tend to travel more miles daily/weekly/annually so if not electrified are likely to emit more from the tailpipe, when non-compliant. The report includes many charts and data some comparing different time frames 2010 – 2024, 2019 – 2024 (all phases of the ULEZ), 2023-2024 (with and without ULEZ) and some comparing rest of England to central, inner and outer London. The bottom line is that there is, of course, no actual data for "without ULEZ" to compare to data "with ULEZ" for the relevant Sept 2023 – Sept 2024 period, so the GLA have used well qualified professionals to employ the most robust methodology to estimate the likely emissions with and without an extended ULEZ. It must be remembered that the ULEZ is a huge area - the London-wide zone measures 1,500 km2 and covers nine million people and is the same zone as the LEZ for heavy vehicles, making it the largest zone of its kind in the world. Moreover, outer boroughs within the "extended ULEZ" vary significantly, sometimes within each borough, and air quality levels are affected by very many variables. Comparison is therefore complex. The report concludes that "After one year of operation of the London-wide ULEZ, our estimates show that roadside NO_2 concentrations in outer London were on average 4.8 per cent (1.1 µg m^{-3}) lower than would have been expected without the London-wide ULEZ expansion". This takes account of expected vehicle churn, weather and more. Evidence suggests that the ULEZ in all its forms has speeded up the upgrade of the fleet and in so doing has reduced emissions.

Whilst upgraded vehicles will have helped to speed up reductions, Richmond Council's local policies will also contribute, by raising awareness of the effect of transport emissions on air quality and by creating and promoting the Good Move Scheme. This provides discounts for sustainable transport, such as cycle and car hire schemes, and may have encouraged some residents to give up their private vehicles completely in favour of more sustainable transport such as cycling or public transport – this will also help to reduce congestion and improve both health and air quality.

The Council has carried out considerable extra monitoring in 2024 linked to proposed road changes – such as the LTN in Hampton Hill, continued to measure in and around Richmond and Bushy Parks to monitor parks and displacement traffic from parks in response to the proposed Movement Strategy by Royal Parks and ad hoc monitoring to address residents' concerns such as the 9 month TfL road works on the A316 near Manor Circus. These are not permanent sites and it was decided not to include monitoring results in this report. Much data is available on the Council's website here.

From Jan 2022 – Dec 2024, the Council organised a 3-year programme to monitor worst-case scenario for a full year outside all state schools in the borough. Please see Appendix D at the end of the report for the final set of results for schools monitored in 2024. Earlier results are available on the Council website here.

2024 has likely witnessed the likely settling-in of the new "norm" for work travel. For occupations that have allowed, COVID changed the way many people want to work with the acceptance and encouragement of this by most employers. It is likely to remain so, certainly for the near future. A few companies are requesting full return to work but part working from home/part working from the office has become commonplace. Change in working practice is likely to some extent to effect traffic and with it, air quality. It was feared that gains made to air quality during lockdown would be lost once life returned to normal. There is no evidence of this. Levels in 2024 are significantly better than in 2019 at the height of lockdown, when 27 x sites (42%) exceeded the UK limit value of 40 µg m^{-3}. These significant reductions confirm the downward trend in air pollution, which is very encouraging.

Trend graphs in Figure A (p32) and Figure B (p34) below, clearly demonstrate this general trend, which, despite a few fluctuations remains downward.

Many factors at all levels of central, mayoral and local government contributed to this.

From a central government perspective, dieselgate back in September 2016 resulted in measures that should not be underestimated for their continuing benefits on air quality. It led to the replacement of laboratory-based emission testing with the

more accurate and realistic real-world driving cycle tests. This provided differing, more robust data about vehicle performance and emissions in actual driving conditions. This has benefited levels of air quality ever since, as motoring manufacturers were forced to produce vehicles which met certification values under real on-road driving conditions. This continues to deliver improvements in later Euro 6 vehicles which really are much cleaner when compared to earlier Euro 6 versions. It also helped raise the profile of air quality nationally, making it a consideration for more people when purchasing vehicles. Many are switching to electric or hybrid, helped by the government's new Zero Emission Vehicle (ZEV) Mandate. This mandates that car manufacturers sell a certain percentage of zero-emission vehicles each year which started at 22% of cars and 10% of vans in 2024 and will increase to 80% of cars by 2030 and 100% by 2035. The government is now committed to phasing out the sale of new cars powered solely by internal combustion engines from 2030. It will permit the sale of Hybrid Electric Vehicles (HEVs) and Plug in Hybrid Electric Vehicles (PHEVs), alongside ZEVs in the 2030 to 2035 period. The ZEV mandate is designed to encourage the transition to electric vehicles and reduce emissions.

According to the SMMT (Society of Motor manufacturers and Traders) 2024 witnessed a 2.6% overall increase in car sales in 2024 compared to 2023 up to nearly 2,000,000. Despite the fact that EV sales reached new record numbers, they failed to reach the mandated target of 22%, achieving 19.6% of all new car sales. (Manufacturers can shift EV sales to later years when demand is expected to be stronger). Increases were reported in EV, (electric vehicle), HEV (Hybrid Electric Vehicle) and PHEV (Plug-in Hybrid Electric Vehicle) whilst decreases were reported in petrol and diesel. Petrol still accounted for more than half of all car sales, more than 1,000,000 (56%), diesels dropped to around 120,000 (7.5% - now the smallest market share by fuel type) and combined EV, PHEV and HEV rose to over 810,000 (36.5%). The ZEV mandate appears to be working but some manufacturers think more government incentives are needed. Richmond, one of the highest per capita car ownership London boroughs, needs a better coverage of reliable public transport, combined with more uptake by residents and workers of sustainable transport including

cycling and walking, and a move away from private car ownership in favour of car clubs for journeys where cars are considered the better option. The Council has various policies to encourage all of these.

Throughout 2024 Richmond Council has continued to encourage the healthy streets strategy, has introduced 15 school streets to encourage walking, scootering and cycling to school and encouraged modal shift away from the private car to bikes, cargo bikes, walking and public transport. Richmond has the largest e-cargo bike hire scheme in London. Even in outer London where public transport cannot compete with central London, planning applications are assessed and encouraged, where realistic, to be car free or car “lite”. Car clubs and free membership for occupiers provided by the developer for 2 years are conditioned where possible to aid the switch. Electric vehicle charge points (EVCP’s) are conditioned in all possible planning applications and are being rolled out beyond target borough wide. Lastly, idling is a political priority for LBRUT. Throughout 2024 the pollution team has erected signage, run campaigns, school workshops and responded to all complaints on engine idling. LBRUT’s traffic wardens have engaged daily with idling drivers and required switch off. In 2024, they issued 8,226 warnings to drivers, down from 10,484 in 2023 and 12,056 in 2021, partly due, they believe, to more compliant drivers and more electric vehicles/vehicles with automatic cut-offs. In the last 6 years they have issued over 61,000 warnings, which is one of the highest across London and probably within the UK. However, despite reducing, the problem persists. A change in law appears unlikely, so the Council is considering other options within the new 2025-30 Air Quality Action Plan. We will update progress in the 2026 report.

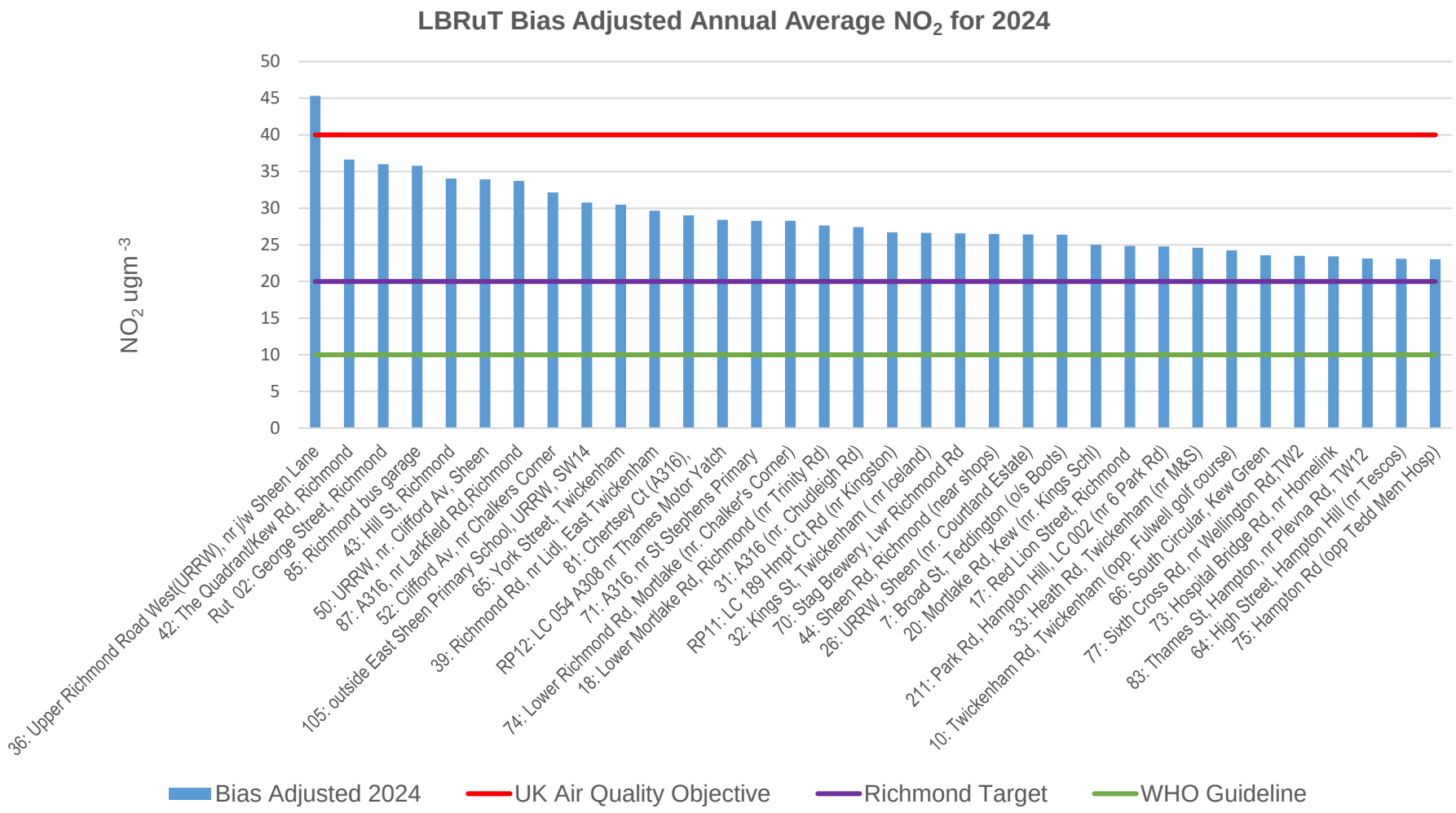
To conclude, the overall monitoring results for the Borough in 2024 are positive, indicate reductions borough-wide and, with the exception of one site in East Sheen, show compliance with the UK annual mean objective for NO_2. This is in line with the modelling prediction for the Borough. However, air quality data does fluctuate slightly year on year. Regardless, we remain optimistic that it will continue on a downward trajectory. Richmond is now on a course to achieve new local targets of 20 µg m^{-3} for annual NO_2, well below UK limit values of 40 µg m^{-3}, and in line with the more stringent limit values, introduced in its 2025-30 Air Quality Action Plan.

It is also working longer-term towards achieving the more stringent voluntary WHO targets of 10 µg m^{-3} set out in September 2021. This will require a step change in the way we live our lives, travel and heat our homes. It will be interesting to see if we can achieve compliance with UK limit values in Upper Richmond Road West near Sheen Lane in 2025 . We will continue to strive to achieve this as soon as possible.

Below are charts, graphs and a map to help visualise the results.

This year we have again included bar charts of data for all sites ranked in order of exceedance, including a red line for the UK limit value of 40 µg m^{-3}, a dark purple line for the new Richmond limit value of 20 µg m^{-3} and a green line for the WHO guideline of 10 µg m^{-3}. A map showing locations is below – indicating good coverage for the whole borough (NB LBRUT has 2x large areas of Royal Parks – Richmond and Bushy Park).We also include 20 representative sites, grouped by area, in our trend charts, covering town centres, main roads, a level crossing and a background site from 2002 – 2024 to give more perspective to levels of NO_2 over a long time period.

Figure A. Bias Adjusted Annual Average NO_2 Concentrations for 2024 at all Sites (split over 2 graphs)



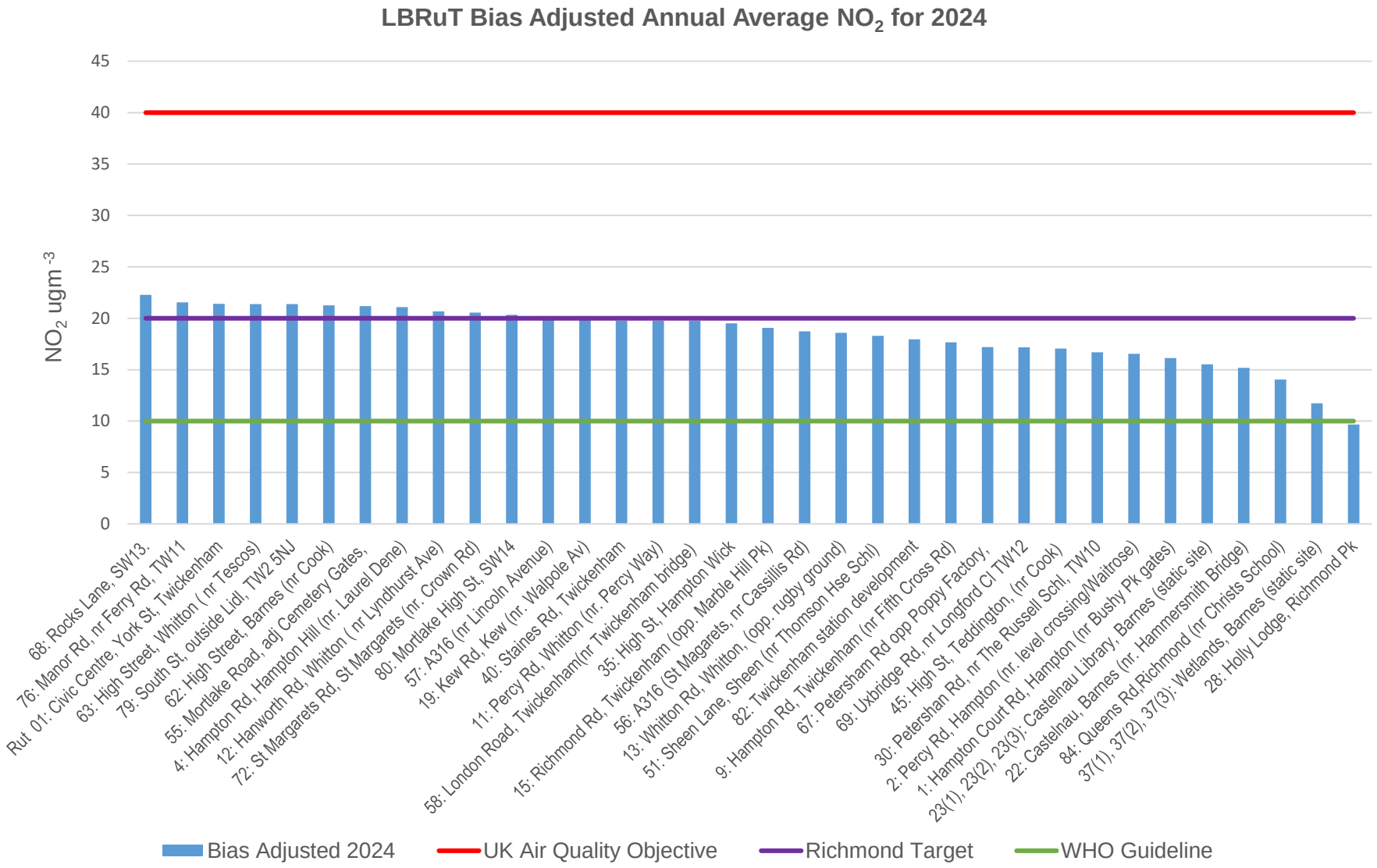
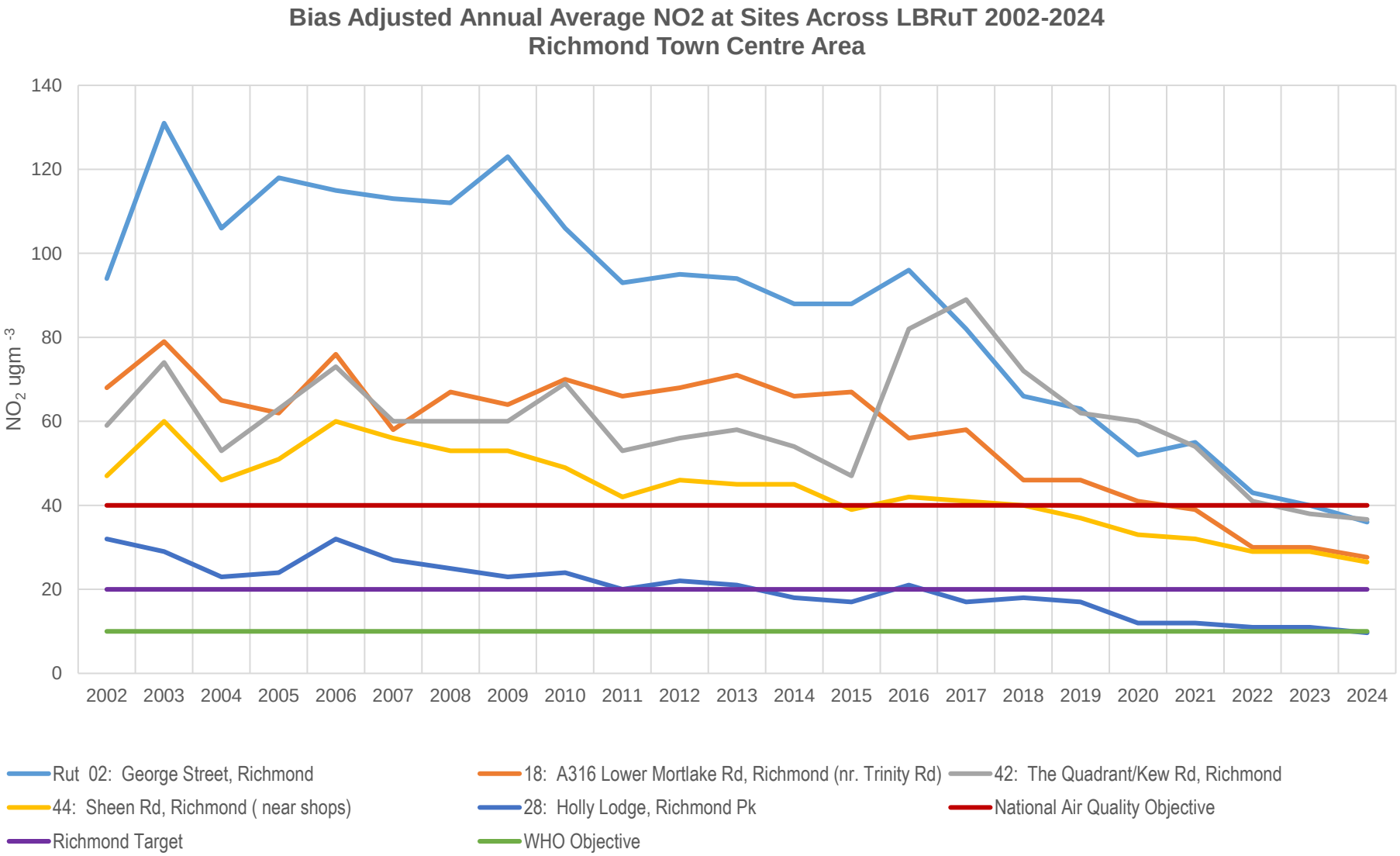
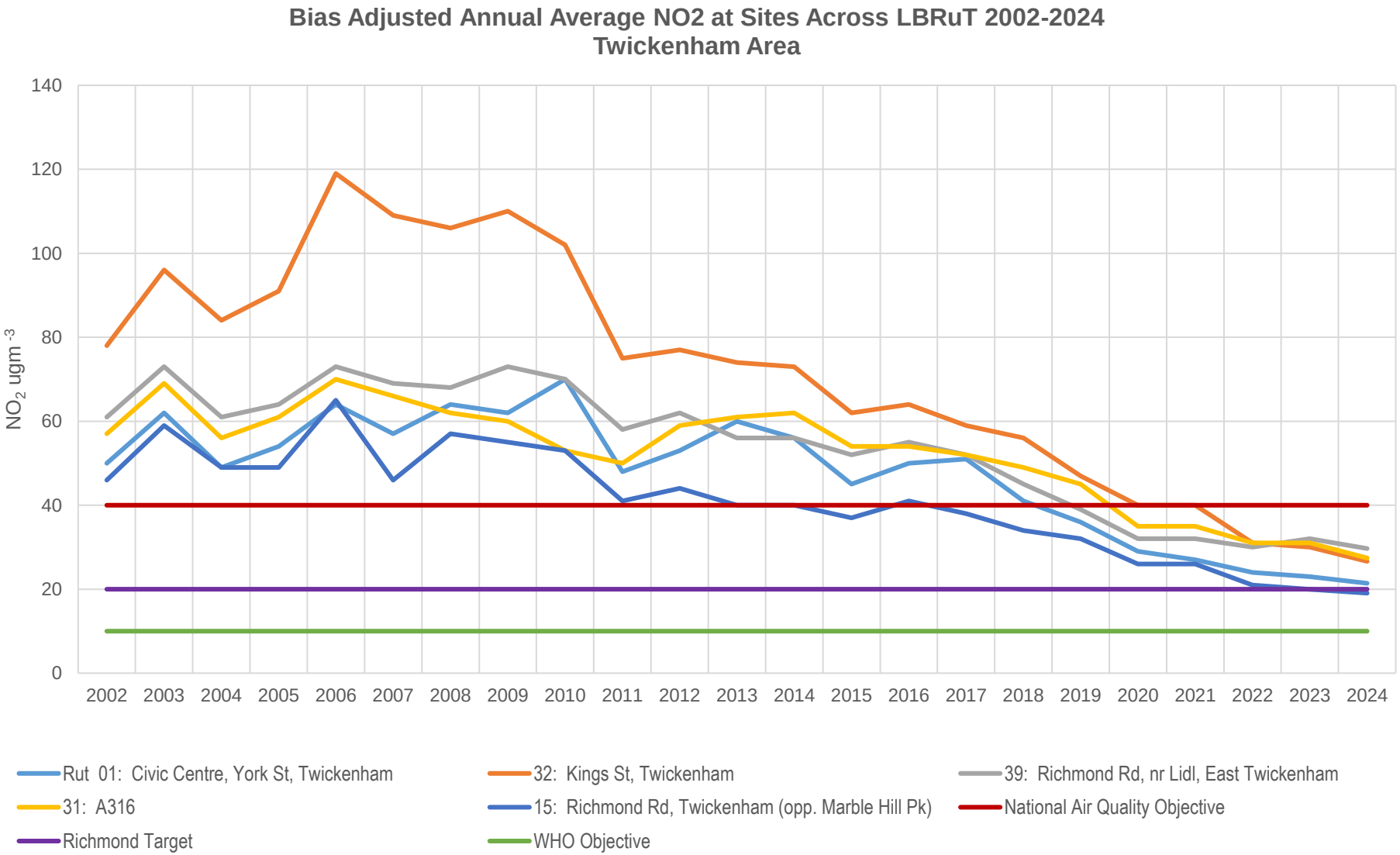
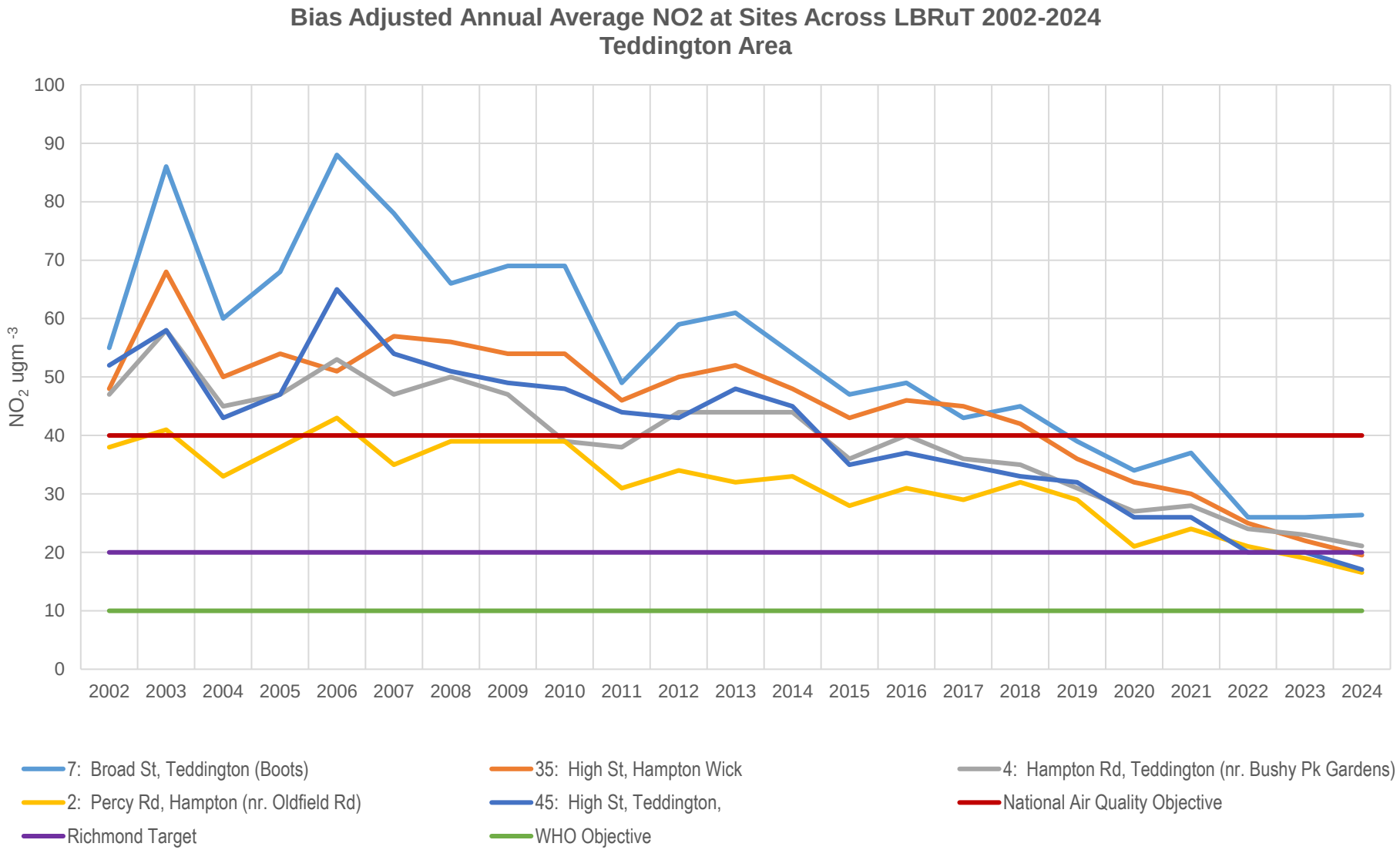
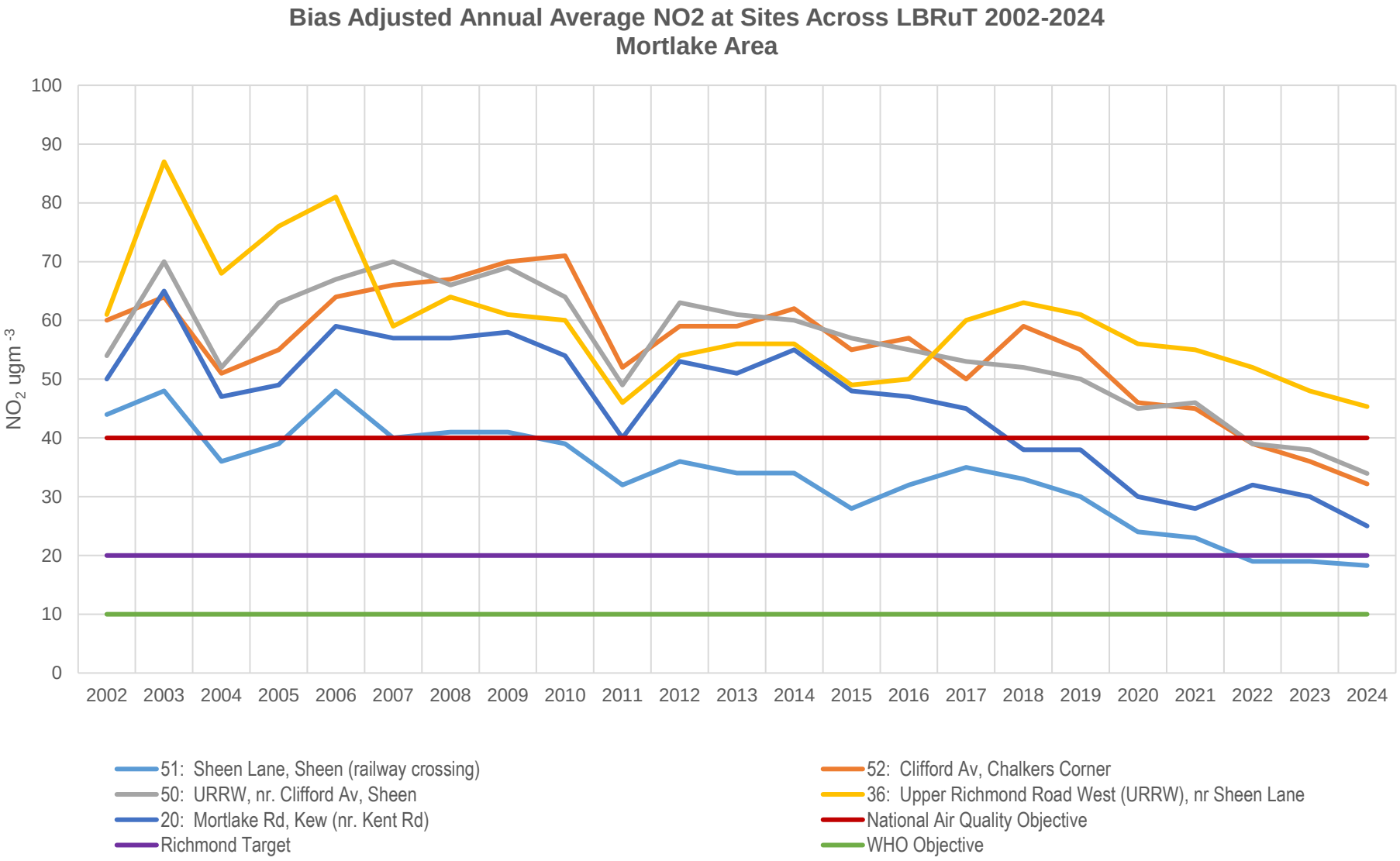

LBRuT Bias Adjusted Annual Average NO2 for 2024
NO2 ugm-3
45
40
35
30
25
20
15
10
5
0
68: Rocks Lane, SW13.
76: Manor Rd, nr Ferry Rd, TW11
Rut 01: Civic Centre, York St, Twickenham
63: High Street, Whitton (nr Tescos)
79: South St, outside Lidl, TW2 5NJ
62: High Street, Barnes (nr Cook)
55: Mortlake Road, adj Cemetery Gates,
4: Hampton Rd, Hampton Hill (nr. Laurel Dene)
12: Hanworth Rd, Whitton (nr Lyndhurst Ave)
72: St Margarets Rd, St Margarets (nr. Crown Rd)
80: Mortlake High St, SW14
57: A316 (nr Lincoln Avenue)
19: Kew Rd, Kew (nr. Walpole Av)
40: Staines Rd, Twickenham
11: Percy Rd, Whitton (nr. Percy Way)
58: London Road, Twickenham(nr Twickenham bridge)
35: High St, Hampton Wick
15: Richmond Rd, Twickenham (opp. Marble Hill Pk)
56: A316 (St Magarets, nr Cassillis Rd)
13: Whitton Rd, Whitton, (opp. rugby ground)
51: Sheen Lane, Sheen (nr Thomson Hse Schl)
82: Twickenham station development
9: Hampton Rd, Twickenham (nr Fifth Cross Rd)
67: Petersham Rd opp Poppy Factory,
69: Uxbridge Rd, nr Longford Cl TW12
45: High St, Teddington, (nr Cook)
30: Petershan Rd, nr The Russell Schl, TW10
2: Percy Rd, Hampton (nr. level crossing/Waitrose)
1: Hampton Court Rd, Hampton (nr Bushy Pk gates)
23(1), 23(2), 23(3): Castelnau Library, Barnes (static site)
22: Castelnau, Barnes (nr. Hammersmith Bridge)
84: Queens Rd,Richmond (nr Christs School)
37(1), 37(2), 37(3): Wetlands, Barnes (static site)
28: Holly Lodge, Richmond Pk
Bias Adjusted 2024
UK Air Quality Objective
Richmond Target
WHO Guideline

Figure B. Bias Adjusted Annual Average NO_2 Trends at Sites Across LBRuT 2002-2024

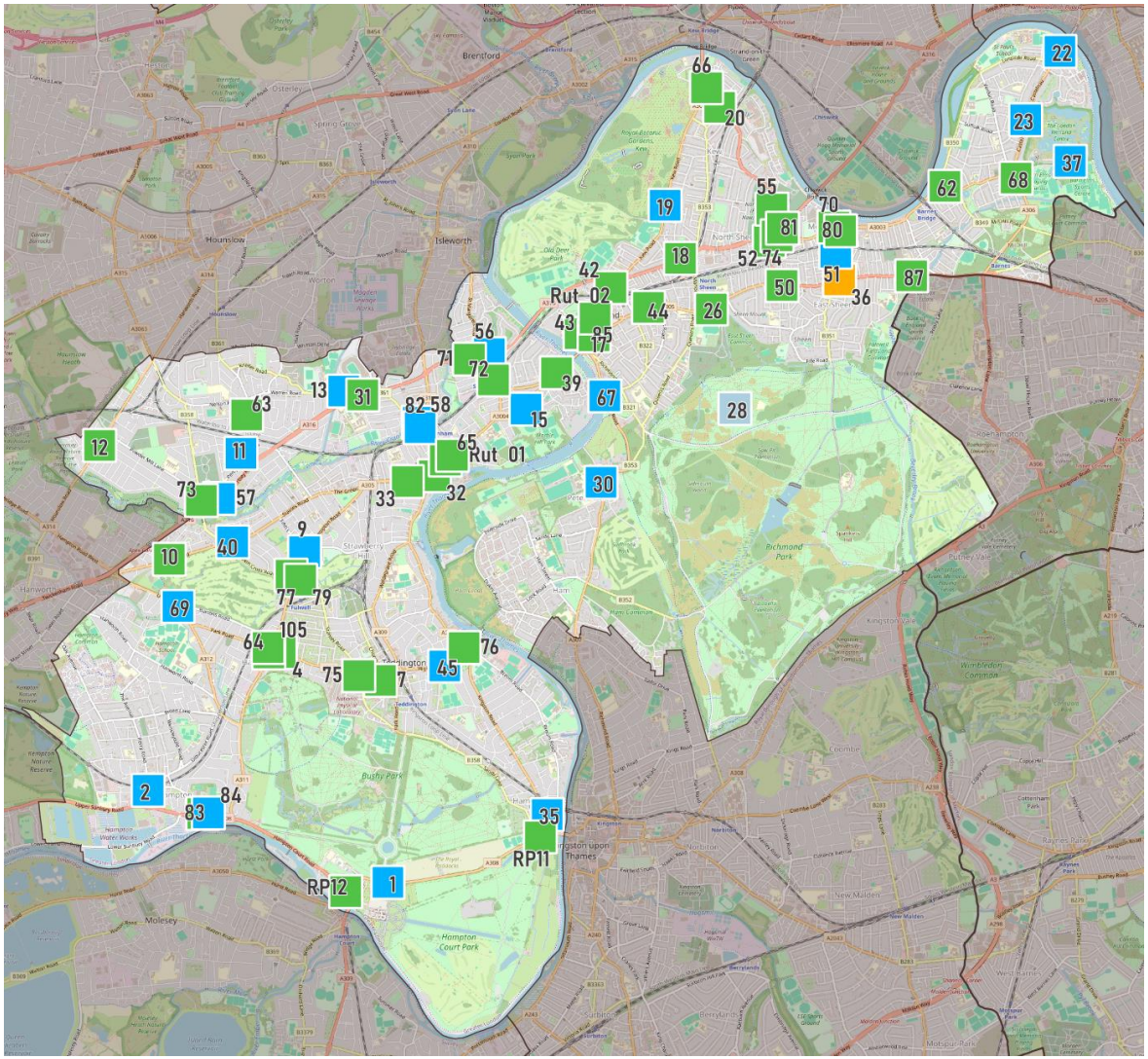



Bias Adjusted Annual Average NO2 at Sites Across LBRuT 2002-2024
Twickenham Area
140
120
100
80
60
40
20
0
NO2 ugm -3
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
Rut 01: Civic Centre, York St, Twickenham
32: Kings St, Twickenham
39: Richmond Rd, nr Lidl, East Twickenham
31: A316
15: Richmond Rd, Twickenham (opp. Marble Hill Pk)
National Air Quality Objective
Richmond Target
WHO Objective


Bias Adjusted Annual Average NO2 at Sites Across LBRuT 2002-2024
Teddington Area
NO2 ugm -3
100
90
80
70
60
50
40
30
20
10
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
7: Broad St, Teddington (Boots)
35: High St, Hampton Wick
4: Hampton Rd, Teddington (nr. Bushy Pk Gardens)
2: Percy Rd, Hampton (nr. Oldfield Rd)
45: High St, Teddington,
National Air Quality Objective
Richmond Target
WHO Objective


Bias Adjusted Annual Average NO2 at Sites Across LBRuT 2002-2024
Mortlake Area
NO2 ugm -3
100
90
80
70
60
50
40
30
20
10
0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
51: Sheen Lane, Sheen (railway crossing)
50: URRW, nr. Clifford Av, Sheen
20: Mortlake Rd, Kew (nr. Kent Rd)
Richmond Target
52: Clifford Av, Chalkers Corner
36: Upper Richmond Road West (URRW), nr Sheen Lane
National Air Quality Objective
WHO Objective

Map of NO_2 diffusion tube sites in LBRUT in 2024



Legend

Annual average NO_2 concentration (µg m^{-3})

0-9	WHO objective compliant (10 µg m^{-3})
10-19	Richmond target compliant (20 µg m^{-3})
20-39	National air quality objective compliant (40 µg m^{-3})
40+	Non-compliant

Table F. NO_2 Automatic Monitoring Results: Comparison with 1-hour Mean Objective, Number of 1-Hour Means >200 µgm^{-3}

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid data capture for monitoring period %(a)	Valid data capture 2024 %(b)	2018	2019	2020	2021	2022	2023	2024
Castelnau Library, Barnes (RI1)	522500	177166	Roadside	100	99.0	0	0	0	0	0	0	0
Wetlands Centre, Barnes (RI2)	522993	176731	Urban Background	100	86.0	0	0	0	0	0	0	0

Notes

Results are presented as the number of 1-hour periods where concentrations greater than 200 µg m^{-3}have been recorded.

Exceedance of the NO_2 short term AQO of 200 µg m^{-3} over the permitted 18 hours per year are shown in **bold**.

If the period of valid data is less than 85%, the 99.8th percentile of 1-hour means is provided in brackets.

(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%)

Table F provides the results of automatic monitoring for NO_2 for the 1-hour mean objective of 200 µg m^{-3}. It was met at all sites and for every year reported. This is very good news. The data for 2024 at RI1 and RI2 is fully ratified.

Table G. Annual Mean PM_{10} Automatic Monitoring Results (µg m^{-3})

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid data capture for monitoring period %(a)	Valid data capture 2024 %(b)	2018	2019	2020	2021	2022	2023	2024
Castlenau Library, Barnes (RI1)	522500	177166	Roadside	100	99.0	19	15	15	16	15	15	16
Wetlands Centre, Barnes (RI2)	522993	176731	Urban Background	100	84.0	15	16	16	15	14	12	15
NPL Teddington AURN (TD5)	522993	176731	Suburban	N/A	10	N/A	N/A	13	12	14	16	N/A

Notes

The annual mean concentrations are presented as µg m^{-3}.

Exceedances of the PM_{10} annual mean AQO of 40 µg m^{-3} are shown in **bold**.

All means have been "annualised" in accordance with LLAQM Technical Guidance, if valid data capture is less than 75% and more than 25%.

(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%).

All data for PM_{10} at Castlenau and Wetlands is fully ratified.

Warning: Data capture at NPL in Bushy Park was 10% for 2024, it has therefore been decided to exclude data from this report. It has been retained for ease of access to earlier years.

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 Imperial College London, when they process our monitoring data. As mentioned in section 1, PM_{10} is a specified pollutant for the whole Borough AQMA.

Table G provides results of automatic monitoring of PM_{10} and a comparison with the annual mean objective. The objective of 40 µg m^{-3} was met at all sites for every year reported. All data is fully ratified.

The 2024 annual mean for PM_{10} at the roadside site in Castelnau Barnes increased slightly from 15 µg m^{-3} to16 µg m^{-3}, which is what it recorded in 2021, recording 15 µg m^{-3} in 2019, 2020, 2022 and 2023. The 2024 annual mean for PM_{10} at the background site at the Wetlands Centre in Barnes increased from 12 µg m^{-3} in 2023 to 15 µg m^{-3} in 2024, again the same as it had recorded in 2021 and in 2018, going up slightly to 16 µg m^{-3} in 2019 and 2020 and down to 14 µg m^{-3} in 2022 and to 12 µg m^{-3}, a more significant drop, in 2023. This really does demonstrate that the levels can go up and down slightly year on year and that roadside and background levels for PM_{10} do not vary by very much. It also proves how exceedingly challenging it will be to reduce particulates. Unfortunately, data capture at the NPL AURN site, also a background, decreased even further in 2024 to 10%, so this is too low to draw any reliable conclusions. We will keep a close eye on levels. As has been pointed out under the NO_2 section, Castelnau has seen significantly less traffic 2019 – 2024 due to the closure of Hammersmith Bridge, at the end of Castelnau, to all traffic from 10th April 2019. The bridge has undergone major repairs and re-opened to pedestrians, bikes and scooters in April 2025 but is likely to remain closed to vehicles for a number of years.

The PM_{10} monitoring results for the LBRuT automatic sites are compared directly to the annual mean and 24 hour mean objectives. Tables G and H provide results for the period from 2018 to 2024 inclusive. PM_{10} measurement was undertaken at three sites and the data capture was very good at one site - RI1 Castelnau achieving 99%, good at R12 Wetlands achieving 84%, which is just below the 85% required for Defra, and very poor at TD5, Bushy Park, Teddington NPL achieving 10%, so data for TD5 has not

been included in this report. As advised, PM_{10} data at Castelnau and Wetlands is fully ratified; dates for ratification at TD5 NPL are unknown.

PM_{10} is proving very difficult to reduce. Over the 7-year period from 2018 – 2024 it has fluctuated slightly one year to the next but has largely remained flat with a very slight downward trend, so we cannot get complacent. Around half of UK concentrations of PM comes from anthropogenic sources in the UK such as wood burning, and tyre and brake wear from vehicles. This is particularly relevant for Richmond borough, where wood burning fires have increased in popularity. Specific efforts are being made to reduce PM's from burning, (see **Table M 2.3**). It is particularly significant to note no decline at either site in 2020, despite reduced traffic due to COVID-19.

It should be noted that whilst all three sites meet the UK limit value (40 µg m^{-3}) only Wetlands just meets the new, stricter WHO guidelines (15 µg m^{-3}) for PM_{10}. Modelling indicates that exceedances on some sections of major roads within the borough, including near Richmond on the A316, should now fall within the UK limit value (40 µg m^{-3}) for PM_{10}. In February 2025 Richmond Council installed a new automatic monitoring station in Richmond town centre, monitoring both PM_{10} and $PM_{2.5}$ and plans to invest Section 106 funding to add PM2.5 to the Wetlands background site before the end of the year. These results will be added to future reports.

Table H. PM_{10} Automatic Monitoring Results: Comparison with 24-Hour Mean Objective, Number of PM_{10} 24-Hour Means > 50 µg m^{-3}

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid data capture for monitoring period %(a)	Valid data capture 2024 %(b)	2018	2019	2020	2021	2022	2023	2024
Castelnau Library, Barnes (RI1)	522500	177166	Roadside	100	99.0	1	3	0	0	1	1	0
Wetlands Centre, Barnes (RI2)	522993	176731	Urban Background	100	84.0	0	3	0	0	1	1	0 (26.3)
NPL Teddington AURN (TD5)	522993	176731	Suburban	N/A	10	N/A	N/A	2	0	1	2	N/A

Notes

Exceedances of the PM_{10} 24-hour mean objective (50 µg m^{-3} over the permitted 35 days per year) are shown in **bold.**

Where the period of valid data is less than 85% of a full year, the 90.4th percentile is provided in brackets.

(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%).

Warning: Data capture at NPL in Bushy Park was 10% for 2024, it has therefore been decided to exclude data from this report. It has been retained for ease of access to earlier years.

Table H provides the comparison with the 24-hour mean objective for PM_{10}. The objective of no more than 35 days exceeding 50 µg m^{-3} was met at each site for all years reported. In 2024, No exceedances were recorded at any site which is good news. The number of days exceeding the daily standard remains low at all sites for the last 7 years. Again, levels are going up and down year on year so vigilance is required.

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

Elevated PM_{10} levels can result from episodes, which are often the result of local combined with imported transboundary conditions from elsewhere in the UK and Europe.

Table I. Annual Mean $PM_{2.5}$ Automatic Monitoring Results (µg m-3)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Valid data capture for monitoring period %(a)	Valid data capture 2024 %(b)	2018	2019	2020	2021	2022	2023	2024
NPL Teddington AURN (TD5)	522993	176731	N/A	10	10	12	8	8	9	12	N/A

Notes:

The annual mean concentrations are presented as µg m^{-3}.

Exceedances of the $PM_{2.5}$ annual mean AQO of 20 µg m^{-3} are shown in **bold**.

All means have been "annualised" in accordance with LLAQM Technical Guidance, if valid data capture is less than 75% and more than 25%.

(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%).

Warning: Data capture at NPL in Bushy Park was 10% for 2024, it has therefore been decided to exclude data from this report. Table I has been retained for ease of access to data in earlier years.

The Council, together with many other local authorities in London, did not have an automatic PM2.5 monitor in 2024 but one was installed in Richmond town centre in February 2025, so reliable Council monitoring results should be available for future reports.

2. Action to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 12 months. The AQAP should specify how air quality targets will be achieved and maintained and provide dates by which measures will be carried out.

A summary of the whole borough AQMA declared by the London Borough of Richmond upon Thames can be found in **Table L**.

The official declared name of AQMA as presented on UK-AIR is "The whole borough AQMA of the London Borough of Richmond upon Thames". It was declared on 31st December 2000 and has never been amended or revoked. No changes to the AQMA are currently proposed.

The air quality objectives pertinent to the current AQMA designation are as follows:

NO_2 annual mean with an annual air quality objective of 40 µg m^{-3}.
PM_{10} annual mean with an annual air quality objective of 40 µg m^{-3}.

The London Borough of Richmond upon Thames whole borough AQMA is located in the Southwest corner of Outer London. In air quality terms, this means that the prevailing south-westerly wind (roughly 75% of the year) brings in relatively fresh air to the LBRuT, before it blows towards the centre of London. In practice, the wind blows from all points of the compass, and this includes receiving air blowing out from the centre of London.

Table L presents a description of the single whole borough AQMA that is currently designated within the London Borough of Richmond upon Thames. Appendix C provides a map of the AQMA (the whole borough) and also the air quality monitoring locations within the AQMA.

Table J Automatic Monitoring of Sulphur Dioxide

NA. Monitoring of sulphur dioxide ceased in 2011.

Table K Automatic Monitoring of Other Pollutants

NA. Monitoring other pollutants ceased in 2012.

Table L. Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Number of Years Compliant with Air Quality Objective	Name and Date of AQAP Publication	Web Link to AQAP
London Borough of Richmond upon Thames London Borough of Richmond upon Thames	31 December 2000	NO_2 annual mean	LBRuT	No	90.6 in 2002, following Stage 4 assessment, in May 2002 46 exceedances out of 57 sites	45.3 in 2024 1 exceedance out of 68 sites	0	London Borough of Richmond upon Thames Air Quality Action Plan (2020-2025). Published March 2020 London Borough of Richmond upon Thames Air Quality Action Plan (2020-2025). Published March 2020	https://www.richmond.gov.uk/media/apcobnkp/air_quality_action_plan_2020_to_2025.pdf
	31 December 2000	PM_{10} annual mean and 24-Hour Mean	LBRuT	No	0 annual mean exceedences out of 3 sites; Highest concentration 28.0 µg m^{-3} (6 exceedances	0 exceedances. Highest concentration is14.6 (0 exceedances of the 24-hour mean)	24		

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance: Declaration	Level of Exceedance: Current Year	Number of Years Compliant with Air Quality Objective	Name and Date of AQAP Publication	Web Link to AQAP
					of the 24-hour mean)				

☒ **The London Borough of Richmond upon Thames confirm the information on UK-Air regarding their AQMA is up to date**

☒ **The London Borough of Richmond upon Thames confirm that all current AQAPs have been submitted to GLA**

2.2 Air Quality Action Plan Progress

The Council approved an AQAP for 2020 – 2025 on 10th March 2020. This is the final year of reporting on this AQAP. The Council has already approved a new AQAP for 2025-30 which will be reported in the 2026 Annual Status Report.

The 2020 – 2025 AQAP involved direct consultation and engagement with community groups. The result is a more robust, more transparent, more accountable AQAP and is public facing. Improving air quality in the borough is a political priority The 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 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.

Members want to prioritise air quality in LBRuT and have demonstrated this by asking officers to bring forward the consultation process and date for committee decision for the new updated 2025 – 2030 AQAP, which was formally approved on 7th April 2025. Officers launched what has recently been recognised as an award-winning strategy to engage with Community groups, involved from the outset, whose ideas and opinions have been employed to shape the new AQAP. Progress on the new 2025 – 2030 AQAP will be reported in our 2026 ASR.

Table M provides a brief summary of the London Borough of Richmond upon Thames' progress against the 2020 - 2025 Air Quality Action Plan, showing progress made during 2024. New projects, which commenced in 2024, are shown at the bottom of the table.

Table M. Delivery of Air Quality Action Plan Measures

NB - Top Three Measures are included at the top of the matrix and explained in more detail under relevant measure.

Measure	LLAQM Action Matrix Theme	Action	Estimated/Actual Completion Date	Organisations Involved	Progress Emissions/Concentration data /Benefits Negative impacts / Complaints
7.2	Cleaner transport	Tackle anti-idling borough wide	ongoing	Local Authority Environmental Health, Traffic wardens	Daily idling enforcement by traffic wardens borough wide with a focus on hotspots – level crossings and schools. Supplemented by events and campaigns delivered by the Air Quality Team
1.7	Monitoring and other core statutory duties	Provide robust far-reaching consultation for draft AQAP	2025	Local Authority Environmental Health	Robust engagement strategy for draft AQAP to involve as many people as possible, in person borough wide, Q&A online including webinars and social media. Winner of Fleet International Air Quality Strategy..
7.5	Cleaner transport	Install electric points for mobile food vendors	2024	Local Authority Environmental Health	Electrical points installed for all viable food vendors to stop day long idling. Licenses updated to require plug-in.
1.1	Monitoring and other core statutory duties	Maintain our monitoring regime in the borough	ongoing	Local Authority Environmental Health	LBRUT believes monitoring is the backbone of air quality, essential to identifying and understanding problem areas, vital to inform solutions and interventions. Throughout 2024, LBRUT maintained 2 x automatic stations monitoring NO_2, PM_{10} and O_3 and 68 x permanent NO_2 diffusion tube sites borough wide. LBRuT replaced the stolen mobile air quality station with a static site in Richmond town centre in February 2025. Data for this station will be included in the 2026 ASR.

					LBRUT is part of the LAQN and values the work done by Imperial College to help achieve and maintain the highest possible standards. Bias adjusted annual results in ASR's are published on the council website as soon as approval is received here Annual Status Reports and Air Quality Action Plans - London Borough of Richmond upon Thames
1.2	Monitoring and other core statutory duties	Present quarterly updates through the air quality action plan in simple to use format and ensure complete transparency	2025	Local Authority Environmental Health	Results are continually updated and made publicly available. Latest raw data is available quarterly online here https://www.richmond.gov.uk/services/environment/pollution/air_pollution/air_quality_monitoring_and_data The AQAP is updated regularly and meetings held with community groups to ensure transparency and to listen to ideas and concerns. Data is regularly provided for concerned residents and Cllrs or anyone who requests it on request. Detailed explanations together with additional monitoring is offered and provided.
1.3	Monitoring and other core statutory duties	Continuous review and improvement of the Air Quality Network throughout the borough	ongoing	Local Authority Environmental Health	Sites are reviewed and updated annually. Review is carried out in December each year; new sites commence in January to enable full 12-month data sets. The Council listens to concerns from residents. Suggestions from community groups and individuals are received throughout the year and included where possible, sometimes for short term monitoring, sometimes for permanent sites. Throughout 2024, the Council ran approximately an additional 60 x diffusion tube sites per month to satisfy this demand.

1.4	Monitoring and other core statutory duties	Positively encourage and support citizen science activities where these actively contribute to identifying and tackling air pollution in the borough. Including the provision of Diffusion Tubes and handheld monitoring	ongoing	Local Authority Environmental Health	Target: to support 4 projects including up to 150 additional diffusion tubes for locations borough wide. The Council exceeded its target; it installed in excess of 500 x additional NO_2 diffusion tubes for 4 separate projects plus ad hoc hot spot monitoring in 2024. In 2024, 1 x project involved the comprehensive monitoring of schools for a full 12 months and 3 x projects involved proposed road schemes – 1 x proposed LTN in Hampton Hill, 1 x school on the extended ULEZ (East Sheen Primary School on the South Circular/ ULEZ which was extended on 29/8/23 and potential displacement traffic for the Royal Parks Movement strategy. Royal Parks have proposed to stop through traffic in Richmond and Bushy Parks. Potentially this could be harmful to health for those living on displacement routes such as the South Circular. The Council has therefore worked with Royal Parks to establish robust monitoring within both Parks and along displacement routes outside. In all cases data was provided and will continue to be provided to help inform decision-making. Work with East Sheen Primary School has continued to help measure any effects of the extended ULEZ on 29/8/23. This was in response to concerns from parents and the head teacher. In 2024, the Council also maintained 20 x low cost Breathe London sensors when the Internet of Things project concluded. All are sited in High streets and near schools, some co-located with NO_2 diffusion tubes. The Breathe London real time sensor network has proved popular with residents and Cllrs providing real time

					indicative data showing expected diurnal peaks and troughs for both NO_2 and $PM_{2.5's}$. From October 2024 this was managed directly by the sensor provider Clarity; data is available via Clarity OpenMap: https://map.clarity.io
1.5	Monitoring and other core statutory duties	All schools in areas of poor air quality to be incorporated into our monitoring network and regime	2024	Local Authority Environmental Health	We had already monitored schools in areas of poorer air quality and from modelling, no other schools were likely to exceed annual limit values of 40ug/m3 for NO_2.but due to growing concerns, we decided all schools should be monitored over a 3 year period from 2022 - 2024. Results for schools monitored in 2024 are in Appendix C. LBRUT continued to monitor certain schools as part of its permanent air quality monitoring programme. This included St Stephens School on the A316 and East Sheen Primary on the South Circular. These 2 schools are sited near higher polluting roads in the borough, so we are keen to keep a close eye on monitoring results. Both schools were part of the Mayors air quality audits in 2018 and received funding to mitigate exposure. Both were compliant in the playground where children play and inside classrooms. Both schools received additional monitoring in 2024 which confirmed significant reductions and compliance both on the pavement outside and within the school grounds. Ad hoc air quality monitoring is offered to all schools and is regularly provided to help address concerns and to deliver projects
1.6	Monitoring and other core	Roll out monitoring to all schools in the borough to provide information	2024	Local Authority Environmental Health	Target: 12 monitoring sites per annum in Primary Schools. In 2021, following concerns from Cllrs and parents, it was decided to increase this target – both the duration and the number of schools. Therefore, as advised above, from

	statutory duties				1/1/22 LBRuT commenced a 3-year programme to monitor 24/7 for a full year worst-case scenario outside all state schools within the borough. In 2024, the 3rd and final year of this programme, the Council monitored at 12 Primary and Secondary Schools for 12 months, for more robust data. This is in addition to 7 schools which are monitored as part of the permanent monitoring schedule or part of road scheme monitoring. Results for the schools monitored in 2024 are in appendix D. In addition, hot spot monitoring for 1-month NO_2 and hot spot PM_{10} and $PM_{2.5}$ at any school that requests it, is always available. Annual monitoring continued throughout 2024 at 4 sites in and around East Sheen Primary School on the South Circular, post implementation of the extension of the ULEZ to the north and south circulars, as requested by the school due to parental concerns.
1.7	Monitoring and other core statutory duties	Implement a new interactive AQAP, which will be updated regularly to provide transparent and concise updates to measure our performance as a borough. Air quality data to be updated quarterly.	ongoing	Local Authority Environmental Health	AQAP was adopted by Cabinet on 10/3/20 and the AQAP is available on the Council website. Air quality data is now updated quarterly on the Council website here Air quality monitoring and data - London Borough of Richmond upon Thames A new AQAP was due to be commenced in 2025 but Members requested that this be bought forward a year to support innovative and robust air quality policy in LBRuT. The Air Quality team were delighted to enable this, and a new AQAP was adopted on 7th April 2025 which will be reported in the 2026 report. This demonstrates the

					commitment of both officers and Cllrs to the air quality agenda.
1.8	Monitoring and other core statutory duties	Invest in new monitoring equipment as new technology moves forward. This could see enhancement to the diffusion tube network and help provide real time data	2024	Local Authority Environmental Health	Target: 1 or 2 new monitors per year to be tested. Various products under consideration. In 2024 the Council continued to provide in house funding for 20 x air quality sensors to continue real time “low cost” air quality monitoring of NO_2 and $PM_{2.5}$’s borough wide. In 2024 this included 10 sites in town centres and 10 sites at a selection of Primary Schools. This followed on from the successful South London Partnership Defra funded project in 2022 for which LBRUT was a member. In October 2020, it purchased 25 x personal pollution monitors for school and Council staff to help them better understand their own exposure to air pollution. These were used ad hoc throughout 2024 to help pupils and residents better understand exposure on their walk to school, work or leisure activities.
2.1	Emissions from developments and buildings	New buildings and development. We have embedded air quality in our Local Plan and will produce a Supplementary Planning Document (SPD) that will help to deliver our aspirations for cleaner air in the borough. This document will cover all areas of planning and ensure developers focus on air quality throughout the build	June 2020	Local Authority Environmental Health Planning	Ongoing. Air Quality is now embedded in our Local Plan and the borough adopted a new Richmond specific AQ SPD in June 2020, focused on the council’s priorities for new developments, including formalising the Section 106 conditions. The AQ SPD is now applied to all major planning applications, which reinforces the Mayor’s requirements relating to AQ neutral for both buildings and transport. The AQ Officer requests S106 payments wherever possible from developers as part of mitigation measures on major developments.

		and for the life of the development			LBRUT push for AQ positive and healthy streets approach in major developments (Stag Brewery) at the pre-app stage for maximum benefits and inclusion. Car free developments are requested wherever PTAL rates permit. If parking is required, it is requested as a block near entrance. Car club spaces as per LBRUT AQ SPD and electric vehicle charge points as per London Plan plus robust travel and servicing plans are conditioned. Opportunities for local district heating network are identified wherever possible. Green space is important to LBRUT, so a lot of effort and negotiation both at pre-app and planning stage now takes place with developers and planners to ensure adequate, appropriate and well-located green space is retained/ made available in all new developments; all mature trees are retained wherever possible, often aided by joint working of EH with Parks dept.
2.2	Emissions from developments and buildings	Delivering Cleaner Construction: demolition and construction can have a significant impact on local air quality. We will ensure that sites are regulated in accordance with the Mayor of London's Non-Road Mobile Machinery (NRMM) LEZ where this is applicable. This project is currently being delivered throughout London by our joint regulatory service	ongoing	NRMM team	LBRUT, together with LB Merton are mindful of the large proportion of emissions contributed by Non-Road Mobile Machinery (NRMM). All major sites are therefore visited and requirements enforced by our London wide NRMM team based in our LB Merton offices. Latest NRMM regulations are routinely applied, and planning officers are updated. In 2024, as in 2023, EH at LBRUT requested from Planning that NRMM conditions be imposed on 100% of all major construction sites. Compliance rates for NRMM equipment, on arrival at inspection by the NRMM team was 87.5% which is very good. As time goes on, construction appear more aware of requirements. Continued inspection, however, is considered very important.

					For NRMM details, see table N.
2.3	Emissions from developments and buildings	Continue to raise awareness of the fact that the whole borough is covered by a smoke control order and provide information to suppliers of solid fuels on restrictions within the borough. Actively press for more regulatory powers to cover the impact of wood burning appliances.	ongoing	Local Authority Environmental Health Trading standards	LBRUT accept that solid fuel burning is a major source of PM2.5 (23 -31% in London) that must be controlled at the local level. Addressing this source is crucial for achieving the LES target to meet WHO guideline levels for PM2.5 by 2030. Wood burning stoves and open fires are popular in LBRUT. In 2024 EH investigated all complaints on smoke control. LBRUT is part of the Defra funded London Wood Burning Project (LWBP) and its sister project London Wood Burning Project 2 (LWBP2) and is a member of the GLA engagement group on wood burning. In Autumn/Winter 2023/4 and 2024/5 Richmond with the LWBP raised awareness of the health impacts from internal solid fuel burning on radio, local billboards, backs of buses, on social media and on the Council website. This followed detailed research by Imperial College London in Autumn/Winter 2022/3 to evaluate all types of internal wood and solid fuel burning, which involved monitoring inside and outside homes burning a variety of different fuels in various appliances. The resulting data informed the awareness campaign. More information is available here London Wood Burning Project. For the last 5 years, including 2024/5 Richmond communications team ran a campaign on the Council

					website and on social media to remind residents and businesses of new requirements in smoke control areas. In 2020, bonfires were banned on all Council allotments at all times.
2.4	Emissions from developments and buildings	Promoting and delivering energy efficiency and energy supply retrofitting projects in workplaces and homes through EFL retrofit programs such as RE:FIT, RE:NEW and through borough carbon offset funds.	ongoing	Local Authority Climate Change	The Climate Change team at LBRUT worked on many projects throughout 2024. Delivery of energy efficiency improvements for those on the lower incomes and in the least energy efficient homes were targeted through the Warm Home Packs. The Warm Home Packs project targets households in Richmond who have a combined annual income of less than £40,000 per and an EPC of between D-G. Each eligible household who claims their Warm Home Pack will receive a package of LED lightbulbs, radiator foils and draft excluder tape. The distribution of the Warm Home Packs has been highly successful with 282 packs distributed, which goes beyond the initial target set out and builds on the 1325 Warm Home Packs distributed in the autumn and winter of 2023/24. Richmond launched a group buying solar scheme in November 2024 with partner Make My House Green. The Making Businesses Greener scheme provides energy and sustainability audits for businesses, suggested actions which will reduce energy use and improve sustainability and access to the GreenMark environmental management

2.5	Emissions from developments and buildings	Reduced emissions from council operations, including from buildings, vehicles and all activities.	ongoing	Local Authority Climate Change Facilities Management	Richmond's Scope 1 and 2 emissions for 2023/24 were 2100 tCo2e, compared to our baseline figure of 6414 tCO2e in 2018/19. The figures show an overall decrease in emissions for 2023/24 compared to 2022/23 and the baseline levels in 2018/19. Total emissions decreased by 11.5% between 2022/23 and 2023/24, with a decrease of 67.3% since 2018/19. This includes a 29% reduction in scope 1 emissions, which reflects the reduction in gas consumption in Council buildings from the baseline in 2018/19. A Decarbonisation Strategy for operational buildings has been developed which sets out the priority buildings that will be targeted for decarbonisation work and the Councils long term approach to reducing carbon emissions from buildings. Both Twickenham Library's and Richmond Library's works were completed in September 2024, with fabric improvements and secondary glazing in Twickenham, and secondary glazing installed in Richmond. Vineyard Primary School's LED lights were installed in August 2024 alongside an air source heat pump and LED upgrade being installed at the Hampton Youth Centre as part of phase 2 works. A feasibility study was completed at the Power Station Youth Centre. Stanley Primary and East Sheen Primary had work completed in Spring 2024 through the LED pilot programme. Following the completion of the fleet transition plan by consultants Cenex, a vehicle decarbonisation

					strategy was developed in collaboration with Procurement and Finance. The strategy formalises the process for decarbonisation of the fleet, including the centralisation of all vehicle procurement through the Procurement team, scrutinising the need for vehicles, and ensuring new vehicles are electric vehicles. The strategy was approved in October 2024. The centralisation of vehicle procurement will enable the monitoring of the decarbonisation of the fleet. A paper on the Phase 1 Options Appraisal of electric charging points to operational buildings went to Directors' Board in March 2024. This paper detailed the site selection for Richmond and the number and types of electric chargers to be installed at these sites. Load testing has been conducted in all the sites, and there is enough capacity at each site for delivery of the charging points and to maintain operations. A fire risk assessment has also been completed for each site. Once installation is complete on these sites, the project will be rolled out to other operational sites, including leisure centres. LBRUT continue to reap the benefits from the installation of solar panels on the roof of the Civic Centre, the insulation of original windows in listed buildings, heat pumps and conditions set for contractor fleet through procurement.
3.1	Public health and awareness raising	A new communications strategy developed in partnership with the community and updated	2021 also ongoing	Local Authority Environmental Health	The new communications plan is updated quarterly by LBRUT communications dept. All initiatives are shared and promoted wherever possible, such as idling action awareness raising, Clean Air Day, Car Free day, Asthma

		regularly to highlight initiatives and campaigns. This includes work initiated by the community		Communications team	Awareness Day, Bike week, walk to school week, wood burning and more. New community webpages, as part of the AQAP, were requested by the community to discuss the draft AQAP pre-launch. Once the pages went live and going forward community updates and input on local initiatives are encouraged. This is seen as a useful place to share knowledge.
3.2	Public health and awareness raising	We will actively lead in important campaigns and initiatives that raise awareness within the borough, including clean air day, car free day, airTEXT and idling action campaign events, as well as proactive measures such as the use of road closures and park-lets .	ongoing	Local Authority Environmental Health	BRUT aim for at least 4 campaigns and initiatives a year. In the 6 weeks preceding Clean Air Night we ran a public campaign around burning in homes, via social media and letters to public houses that have open fires, in conjunction with the London wood burning project. For Clean Air Night on 22nd January 2025 the Council's Air Quality team ran a pop-up event in Richmond town centre to discuss wood burning and help everyone make informed heating choices. For Clean Air Day on 20th June 2024, we ran an in-person event in Richmond town centre to provide information on air quality and active travel which included air pollution themed street performers. We ran a primary school poster competition, and the air pollution entertainers visited two schools that have school streets, to raise pupil's awareness of the campaign at the start and end of the day. We encouraged local businesses to consider greener ways to work with suppliers and employees to help reduce contributions to local air pollution. We supported the Ask about Asthma campaign on 9-15 Sept 2024, working with schools and young adults to raise awareness that air pollution can trigger asthma attacks.

					For Car Free Day on 22nd September 2024 we promoted active travel and the many schemes available in the borough to hire bikes, e-bikes and cargo bike network (which has expanded so that every village now has one). The Council again offered free play streets to residents and promoted play streets and active travel to residents and businesses via social media, Council website and Council e-letters. 23 play streets were closed free of charge by the Council over the weekend of 21/22 Sept 2024. We continue to deliver idling action events across the borough, running 10 events at hotspots and schools in 2024. The events engaged with a total of 774 drivers. The AirText early warning alert service when air pollution is predicted to be elevated, was promoted to schools, at events, via the Council website and in response to complaints and enquiries throughout 2024. Alerts are automatically forwarded to doctor's surgeries, schools and pharmacies to raise awareness and reduce exposure amongst the most vulnerable. From October 2024 – January 2025, as part of our Air Quality Action Plan (AQAP) consultation we carried out in-person engagement with a large number of residents and students via community, youth, art and health centres as well as schools, and holding drop-in events at York House and in town centres together with online webinars. This raised awareness of air pollution as well as what LBRuT are doing to tackle it. In February 2024, the Air Quality team participated in the borough's Schools eco summit attended by 9 schools, giving

					a shortened version of our air pollution workshop to around 80 pupils. In 2024 Church Street Twickenham remained closed to traffic 10am – midnight daily.
3.3	Public health and awareness raising	We will create a new Air Quality & Transport Committee specifically to look at Air Quality and actively engage with the community	2020 ongoing	Local Authority Environmental Health	A single Transport and Air Quality Committee was created to integrate transport and AQ in all decision making on a fundamental and daily basis with one cabinet member covering both departments. In 2024 this resulted in much joint working between Air Quality and other departments such as Highways and Climate Change addressing issues such as clean and green High St recovery, a new e-cargo bike scheme and clean, electric ice cream pitches (see 7.5). It has also resulted in a closer working relationship between the transport and air quality officers, greater awareness among staff for air quality and a higher priority for considering air quality in road improvement schemes.
3.4	Public health and awareness raising	We will work with our Public Health partners and look at the opportunities to join up our campaigns and to deliver joint health benefits of active travel and healthy lifestyles	2021 ongoing	Local Authority Environmental Health	In 2024 Public Health promoted the Richmond Moves campaign, which focuses people within the borough to be more physically active and have healthier lives. As part of this campaign, air quality was also highlighted, including for people to avoid physical activity near busy roads and pollution hotspot areas in the borough. In 2024, meetings continued with PH to deliver joint messaging for health and air quality benefits for numerous strategies around schools, dementia, and the equalities agenda. These followed on from a training module, developed by PH, with input from the Air Quality Team in LBRUT, to help front line NHS workers deliver joint air

					quality messages to vulnerable patients especially those with breathing or heart problems, in the community and schools, via “make every contact count”.
3.5	Public health and awareness raising	We will work with our Communications Team to promote the use of low pollution, back roads for walking or cycling to reduce individual exposure to air pollution	2022 ongoing	Local Authority Environmental Health	The Air Quality team is working closely with Active Travel, School Travel Planner, schools, communications and via local presentations to promote low pollution walking routes. These were also promoted at in person events throughout the year such as Clean Air Day 2024, consultation presentations, webinairs and events for the new AQAP, and attendance at ad hoc community events.
3.6	Public health and awareness raising	We will create a joint action working group that will actively involve communities in the air quality agenda and that reports to the Chair of the new Air Quality & Transport Committee	2020 ongoing	Local Authority Environmental Health	This was created to inform and shape the existing 2020-25 AQAP. It meets once or twice a year, including in 2024, with useful presentations, updates and information from the Air Quality Team, who answer or investigate any questions or concerns raised. It was particularly useful and met numerous times in 2024 to help inform the priorities and wish list of community groups in the drafting of the Council’s new 2025-2030 AQAP. The Council was eager to hear from as many people as possible in the development of the new AQAP and are hopeful that this is reflected in the latest far reaching and ambitious version.
3.7	Public health and awareness raising	We will increase the number of schools with accredited travel plans by 20% per year with an aim to have up to 90% of all schools covered by 2024. We will encourage all	2022 ongoing	Local Authority Environmental Health	LBRUT has a part time Travel Planning Officer to help schools draw up travel plans. LBRUT also encourage walking/cycling to school. LBRUT encourages all schools to sign up to the TfL Travel for Life accreditation scheme. In 21/22 academic year 43 (53%) schools had TfL STARS accredited STP’s, and the same was achieved in 22/23 academic year. As resources have been prioritised

		schools to join TfL STARS programme			elsewhere this number is likely to have dropped for 23/24 academic year – 30 (39%) schools accredited but over 90% 'Engaged' on the new system. All year 6 pupils receive cycling proficiency training before they leave for secondary school. LBRUT also helps schools introduce road safety schemes which has been a big priority for 22/23 and 23/24 academic year with engineers designing and/or consulting on around 15 plus school schemes.
3.8	Public health and awareness raising	Better Legislation: We will actively campaign and participate in the call for a new Clean Air Bill that is fit for the future.	2021 ongoing	Local Authority Environmental Health	LBRUT together with other London authorities and London Councils continue to attend meetings with Defra and respond to consultations, including on Defra's Environment targets, the latest Air Quality Strategy, PM2.5's, and smoke control legislation to try to strengthen targets and standards.
3.9	Public health and awareness raising	Burning in the borough: We receive regular complaints and concerns from residents about bonfires in the borough.	2021 ongoing	Local Authority Environmental Health	We have banned bonfires on all borough allotments and may consider further restrictions. Bonfires are a major source of harmful PM2.5's. We have substantial online information, strongly discourage all forms of burning, have contact forms and a contact number and respond to all complaints about bonfires. We take swift enforcement action against builder's bonfires. All residents are encouraged to compost green and organic waste, use the Council's weekly food waste and recycling services and fortnightly green waste collection or visit Townmead Rd Reuse and Recycling Centre.
3.10	Public health and awareness raising	Reduce impact of burning unauthorised fuel and the use of wood burning appliances Lobby Government for	2020 ongoing	Local Authority Environmental Health	The whole of LBRUT is a smoke control zone. The Council receives complaints about smoke from a chimney every year. All reported cases are investigated and enforced.

		additional powers. Take action to address any complaint regarding unauthorised use.			Richmond Council is part of the Defra funded London Wood Burning Project 2 which in Winter 2024 ran campaigns on radio and on the back of buses to advise of health impacts and discourage solid fuel burning borough wide. This was informed by the detailed research results of Imperial College London in 202/3. More information is available here London Wood Burning Project In addition, every year for the last 5 years, Richmond Council has launched smoke control campaigns for residents and businesses on the Council website, in Council e-newsletters which reach 42,000 households and across social media. Officers from LBRUT attend all Defra seminars to ensure they remain up to date with latest legislation and enforcement. A new smoke control order, to bring vessels within scope is under consideration.
3.11	Public health and awareness raising	Audit all schools in areas of poor air quality and provide financial support for measures that tackle and reduce exposure to pollution	2020 ongoing	Local Authority Environmental Health	Following on from the Mayor of London's school audit programme, LBRUT continued to offer an audit to all schools in areas of poor air quality. The Air Quality team audited one school per term and so completed three audits in 2024 (3x primary schools). Each school received a tailor-made report which included observations, monitoring results and a range of recommendations that aim to reduce exposure at and around the school site. The schools received support afterwards to help implement improvements such as installing a green screen or bicycle storage racks. In 2024 Richmond Council became aware of a demand from schools for an air pollution workshop. In response the Air

					Quality team produced an interactive 'air pollution detectives' workshop which was delivered to 4 Primary schools in 2024, engaging an estimated 175 KS2 pupils. This is now considered a greater priority than audits, which have largely run their course.
4.1	Delivery servicing and freight	Develop plans for business engagement, including optimising/greening deliveries, supply chain and waste removal	2021 ongoing	Local Authority Environmental Health	During 2024, the Enterprise and Business Growth Team within the economic development section of Richmond Council, commissioned Carbon Architecture to deliver a Greening Your Business Programme in both LB Richmond and LB Wandsworth. This programme has been delivering support to 25 businesses in Richmond, helping them to become more sustainable, to reduce their carbon emissions and to help them to achieve Level 1 accreditation of the Green Mark . In parallel with this programme, we are also encouraging our local businesses to adopt more sustainable business practices through our main business support programmes and to engage with the newly formed Richmond Sustainability Forum.
5.1	Borough fleet	Richmond will upgrade its own fleet and that of our suppliers to the highest Euro Standards	2025	Local Authority Environmental Health	Reducing emissions from LBRUT's own fleet and that of contractors is seen as key. LBRUT believes it is very important to lead by example, so has a target for the entire fleet to be the latest Euro standard or electric by Dec 2025 By Dec 2024 LBRUT had 73 vehicles, 71 (97.2%) are Euro VI, 1 x hybrid (1.4%) and 1 x EV (1.4%)– zero emission. Issues regarding the installation of EVCP at the Council depot is delaying fleet upgrades. Contractors are incentivised to use clean fleet via procurement (see 7.3)

6.1	Localised solutions	The introduction of a borough-wide 20 mph speed limit. This will help create an environment that is welcoming and safer for pedestrians and cyclists	2020 ongoing	Local Authority Environmental Health	The installation of 20 mph speed limit in over 90 % of all LBRUT roads was completed by April 2020 (implemented in 24 segments). Further reductions have been made, such as along the A310 corridor and parts of Staines Rd, so that by Jan 2024 over 95% of LBRuT roads have 20mph speed limits. This has helped create an environment that is welcoming and safer for pedestrians and cyclists to help encourage and increase the mode share for walking, cycling and public transport, particularly important as we develop the “new norm” post COVID.
6.2	Localised solutions	Provide an independent assessment of the air quality benefits of the new 20 mph speed limit - monitor 3 locations before and after 20 mph limit implemented	2020	Local Authority Environmental Health	Completed. A report was commissioned to review impacts on air quality before and after the introduction of the borough wide 20mph speed limit. Unfortunately, due to COVID and the large number of changes in lifestyles, which affected traffic 2019 to 2020, it was not possible to establish either a positive or a negative effect of speed on levels of air quality. Air quality did improve generally in 2020; it declined slightly or remained the same in 2021 and it has improved at most sites in 2022 and again in 2023. Any impact from speed alone is not possible to ascertain. Speed did reduce slightly with the new 20mph. The traffic survey in early 2021 comparing 2018 to 2020 confirmed a reduction in speed on most roads, contrary to increased speeds affecting much of London during lockdown. From recent traffic surveys in 2024, the average speed continues to reduce slightly, which is good news from a safety perspective.

6.3	Localised solutions	Additional speed reduction measures at A310 Kingston Bridge to Twickenham, A305 Staines Road Corridor and A308 Hampton Court Corridor	2024	Local Authority Environmental Health	These three corridors - A310, A305 and A308 were identified for corridor studies and were taken forward in 2022/23. Works on the A310 corridor commenced in 22/23 with the construction of a part segregated cycle lane along the length of Strawberry Vale/Manor Road. This scheme was completed early 2024 and works then started to consider speed reductions measures along Kingston Road. This scheme was then put on hold pending a review of the Manor Road / Ferry Road junction in recognition that any significant changes here could impact on traffic movements and flow along Kingston Road. Feasibility plans for this junction commenced late 2024 and this is a project to be carried over into 2025. The speed limit was also reduced to 20mph on the A310 corridor between Twickenham and Hampton in January 2024. The works on Hampton Court Road outside the Palace were delayed pending approvals from the Palace given that they part own the land to the front of the Palace. The scheme for an offroad cycle route was consulted on in 22/23 however the proposal received significant opposition and was not approved at Committee. Works commenced again in 2024 to look at ways of enhancing the onroad cycle lanes along this section of road and this work in continuing into 2025. Staines Road did not receive funding sufficient for traffic calming the length of road in 22/23. However, consultation was undertaken in early 2023 for a parking proposal with safety improvements around junctions included. The double yellow lines were improved and implemented in 2023 along

					with a 20mph speed limit between Fifth and Sixth Cross Roads. In addition, a scheme was consulted on between Sixth Cross Road and Apex Corner for raised crossings, a new traffic island and a lower speed of 20mph. The lower limit was not support however approval was granted for improvements around the toucan crossing by Glebe Way and a new traffic island. The toucan works including enhanced cycle measures into the adjacent estate and a raised table were completed in 2024.
6.4	Localised solutions	A new Clean Air Zone (CAZ) for Richmond Town Centre to reduce polluting vehicles and dissuade vehicles from unnecessarily using our town centre as a through route (subject to funding approvals)	Wider plans 2024, following ULEZ	Local Authority Environmental Health	Following the extended ULEZ to outer London in August 2023, LBRUT is now considering wider plans for Richmond town centre which may go above and beyond a CAZ. Traffic reduction measures are being considered in the medium and long term as part development plans for the entire town centre. Throughout 2024, Transport and Air Quality Officers have trialled Virtual Loading Bays (VLBs) via a Defra funded air quality Smarter Green Logistics project headed by Cross River partnership (CRP) to better manage limited parking, provide timed delivery slots and avoid re-visits/ vehicles partly blocking the carriageway due to lack of parking space. All help provide useful data whilst reducing emissions. Defra funding ceased in Dec 2024 but Richmond Council has decided to continue with the project to better manage limited kerbside space. As part of the town centre planning, kerbside activities and uses will be reviewed to improve servicing and reduce air quality impacts from these activities.

					Funding is being sought from TfL to improve Bus operations within Richmond Town Centre to improve operational efficiencies and reduce pollution from these users of the town centre. Targeted improvements in journey times should increase patronage over the private car.
6.5	Localised solutions	Focus our policies and Local Implementation Plan on prioritising cycling and walking in the borough	2020 ongoing	Local Authority Environmental Health	Richmond Council published its Active Travel Strategy in 2020. The strategy includes a detailed list of actions that the council is pursuing to increase walking and cycling in the borough, including a strategic cycle network connecting the key town centres. Despite the pandemic, progress was made towards establishing this network with cycle improvements delivered on Kew Road, Hampton Court Road and Castelnau, with further improvements in development for Hampton Court Road, Hampton Wick Roundabout, Strawberry Vale and Staines Road. The target delivery date is 2025, subject to funding being secured. Other works currently being assessed for cycling include a review of London Road in Twickenham in addition to a detailed assessment of the London Rd/Whitton Rd signals for cycle improvements and continuation of the A310 cycle network with works being considered at the Manor Road/Ferry Road junction this is part of the strategic cycle route. Works continue on the consideration of contraflow cycle lanes in the borough. A scheme was also completed to enhance an existing cycle link which links Arragon Road to Amyand Park Road. We also improved two existing zebra crossings on Church Grove and Hampton Court Road to allow for cycle crossing to take place, these ensure a

					continuous cycle link between Kingston Bridge and Bushy park. Other measures introduced in 2024 include new zebra crossings, two on Shacklegate Lane and one on Arragon Road and a new pelican crossing with wider footways on Friars Stile Road outside The Vineyard School. Work is underway for improved crossings and safer school zones in a number of locations in 2025 including Cromwell Road and Fairfax Road (Teddington), Christchurch Road (East Sheen) and Amyand Park Road (Twickenham) with the target delivery date for these schemes at the end of 25/26.
6.6	Localised solutions	Continuing the roll out of Electric Vehicle Charging in the borough. Target. of 400 EV charging points by 2025	2021 ongoing	Local Authority Environmental Health	Ongoing - ambition to exceed target. Target achieved in 2021. Ambition to achieve more. LBRUT is keen to enable and encourage uptake of zero tail pipe emission vehicles in preference to petrol or diesel vehicles. It accepts the need to provide space on borough roads and in borough car parks for an effective network of charging points of different types to cater for all users. The majority of charge-points are lamp column chargers on residential roads catering for residents without off street parking An additional 224 public chargepoints were added in LBRUT in 2024, comprising 217 lamp column chargepoints, 4 fast (Believ) chargepoints in the Council run Friars Lane car park and 3 rapid chargepoints provided by TfL. In total there were 1,043 chargepoints in place by the end of 2024 (953 slow (lamp column), 82 fast (Source

					London/Believ) and 8 rapid (TfL)). Additional lamp column and fast chargepoints will be added in 2025. The Council is continuing to investigate options with private sector providers for further fast/rapid charger provision at no cost and is also planning a trial of cross-pavement solutions to enable people to use a home charger even if they do not have off-street parking.
6.7	Localised solutions	Investing in Cycling Infrastructure in the borough - 1000 Cycle stands, 30 Cycle Hangers, 200+ Cycle Racks by 2023	2024	Local Authority Environmental Health	The borough is working to rapidly expand its residential bike hangar programme, with 20 new units installed in 22/23, 15 installed in 23/24 and an additional 30 bike hangers creating 180 additional cycle parking spaces in 2024/5. The programme provides secure cycle storage for residents that cannot easily store bicycles within their homes. This is in addition to 30 on-street Sheffield stands. Richmond has now exceeded all cycling infrastructure targets including 1000 cycle stands by 2023. LBRUT does not monitor the number of cycle parking stands installed as part of new developments – they are conditioned as per London Plan 2021 and noted as part of the planning application, but cumulative totals are not available. This is now becoming an important addition particularly for residential cycle parking.
6.8	Localised solutions	To reduce traffic around schools at drop off and pickup times we will be piloting 'School Streets' at selected schools with a view to extend these in the borough	2020 – upgraded due to COVID - ongoing	Local Authority Transport, Parking teams	Richmond Council is endeavouring to promote active travel to school, alongside improved safety and air quality. LBRUT had a target of 3 school streets in March 2020. This target was significantly increased in 2020 during COVID to help with both safety and social distancing around schools. By October 2020 15 temporary schools streets had been installed under phase 1 and 2. In 2021 13 School Streets

					were made permanent and 3 more were consulted upon. In 2022 an additional school street was made permanent. In 2023 1 further School Street was trialled and TAQ committee approved it being made permanent. 1 is still under consideration awaiting a school decision on accesses. As part of Phase 4, a further 5 schools are in the process of being considered and will go to public consultation soon (2 have already been consulted on - Heathfield Infants and Heathfield Junior). These 5 have now been installed as trial School Streets and we are in the early stages of considering 2 or 3 Phase 5 schools. In 2022-25 the political vision for Schools Streets is to improve the visibility of the existing school streets rather than push for many more new ones - we are currently trialling this new feature and will roll out a priority implementation plan going forward once the trial is over.
6.9	Localised solutions	Pilot internal air quality filtration in schools and take part in GLA assessment in effectiveness of different filtration units at nursery schools	2020	Local Authority Environmental Health	Completed. Air filtration units were piloted at 2 x primary schools 2019 – 2020. This pilot is now complete. It emerged that performance was dependent on routine maintenance - i.e. schools replacing/cleaning filters when necessary, which effected the value of the intended report. COVID and funding issues further disrupted this. In 2019, the GLA carried out an audit of 20 nursery schools in London including Windham Nursery School in LBRUT. All received reports and joint funding from the GLA and local authority to help with recommended improvements. In addition, the GLA selected 5 nursery schools for a detailed survey of 5 different air filtration systems. This resulted in a more robust report on the effectiveness of air pollution

					purifiers : https://www.london.gov.uk/sites/default/files/2020212_afs_trial_findings_report_v8.3_inc_apdx.pdf
7.1	Cleaner transport	We will commission a Diesel Levy options paper. We will also benchmark against other leading boroughs	2020 reconsidered 2023	Local Authority Transport, Parking teams	An Emissions based parking levy report was completed in May 2020 looking at 5 options to address both harmful effects of traffic fumes and Climate Change Impacts to support a zero emission target for London by 2050. It reviewed a 2018 report on emission-based resident parking and considered options adopted elsewhere. Following the ULEZ expansion in August 2023, members have considered the option of introducing an emission-based charging system. At the last review of parking charges, the decision was made to set the new charges aimed at encouraging less car usage/ownership to increase the wider use of sustainable transport modes such as public transport, walking and cycling. An emission-based charging structure has not been taken forward at this time as this has been superceeded by the London ULEZ, but it will remain under consideration for future reviews of parking charges
7.2	Cleaner transport	Anti-idling: This is a priority action for the borough and we will be working tirelessly within given resources to ensure that this is tackled for all vehicles including taxis	2020 ongoing	Local Authority Environmental Health Parking, TfL	This is a top political priority. In 2024, traffic wardens engaged with 8226 drivers across LBRUT, warning drivers and requiring switch off. All drivers complied, so no FPNs were issued. This was the 5th year of CEO enforcement and a total of over 61,000 warnings have now been issued. This is far higher than many other London authorities. In 2024 the Council continued their own monthly in-house idling events, some with volunteers and Cllrs, largely around level crossings but also around schools and hotspots in

					response to complaints. LBRUT continued to promote its own pledge for engine idling for businesses and schools, encouraging all schools to pledge not to idle, in return for a large no idling banner. These are displayed as reminders to motorists on boundary fences. In 2024, LBRUT investigated all engine idling complaints, requested traffic wardens support where relevant and erected additional no idling signage where practical. Much work has also been carried out with TfL buses and black cabs outside Richmond and Twickenham stations and at Richmond bus garage, talking to drivers, talking to TfL and Idling Action events at these locations. Compliant vehicle numbers are gradually increasing, partly due to the increase in EV's and vehicles with automatic cut outs, but the problem of idling persists. To try and address this, in the new 2025-30 AQAP Richmond is exploring the potential for a borough wide PSPO to help enforce against idling.
7.3	Cleaner transport	We need to lead by example so we will be developing a 'benchmark test' to gauge the impact of internal decision making around factors such as procurement	2021	Local Authority Environmental Health, Procurement, Climate Change	LBRUT has developed a benchmark test for procurement to help influence and incentivise suppliers to use the cleanest vehicles possible to reduce pollution from Council/contractor logistics and servicing. Euro VI/EV's are required on new contracts and has been required for the 10 year waste and recycling contract. This represents a substantial improvement on the former fleet and will help reduce emissions borough wide. As advised in 2.5, further benefits will materialise via the Climate Change's decarbonisation of the fleet strategy

					The strategy formalises the process for decarbonisation of the fleet, including the centralisation of all vehicle procurement through the Procurement team, scrutinising the need for vehicles, and ensuring new vehicles are electric vehicles. The strategy was approved in October 2024. The centralisation of vehicle procurement will enable the monitoring of the decarbonisation of the fleet.
7.4	Cleaner transport	Tackle Council work place emissions and promote the Council Travel Plan to the Council employees	2021 ongoing	Local Authority Environmental Health, Facilities Management	LBRuT continued to encourage working from home where practical in 2024 and will continue so to do. This will help reduce emissions from travelling to/from work. Throughout 2024 the Council continued to promote healthier travel habits for its staff, including walking, cycling and using public transport for business visits. Work Oyster cards are provided for business travel/site visits on public transport. Cycle to work scheme is encouraged. Cycle facilities on Twickenham campus include showers and changing rooms. Staff cycle parking is increased by removing car parking bays as demand increases. The Council has a shared cargo bike for staff and 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. All initiatives will help reduce emissions.
7.5	Cleaner transport	Licensing & Idling: We will seek to ban diesel emissions when serving ice cream and require all non-itinerant food vans with licensed pitches to plug into an electrical source.	2024 ongoing	Local Authority Environmental Health, Licensing, Climate Change	LBRUT introduced this policy in its AQAP in March 2020 to address a specific concern with idling ice cream vans and food vendors. In 2022, the Air Quality team progressed this action with the Licensing and Climate Change teams to fund free electrical plug in points for all non-itinerant mobile food vendors by

		We will work with our Licensing Team to introduce conditions at annual license renewal to prevent this idling			2024 and to make it a condition at annual license renewal to plug into an electrical source. This went to Licensing Committee on 31/1/23, which means from this date, all new traders must be euro 6 and plug into an electrical feeder pillar where one is supplied by the Council for power whilst trading. No idling will be permitted. Existing traders must be euro 6 compliant by 1/1/24 and likewise plug into an electrical feeder pillar where one is supplied. By December 2024, all viable static sites for mobile food vendors, including 2 challenging sites requiring running cable within the structure of Hampton Court bridge, had plug in points. All are now required to be used. The 3 remaining sites are all riverside locations in Petersham, Ham and Twickenham. Distance from a UKPN jointing point makes Petersham and Ham sites cost prohibitive and Twickenham Riverside is about to be redeveloped – a new plug in point is included in the new development. Battery/electrical generators are under consideration for non-viable pitches.
7.6	Cleaner transport	Support the development and use of 'Car Clubs' in new residential developments, by station interchanges and in town centres.	ongoing	Local Authority Transport and Environmental Health teams	Car clubs operate throughout the borough and are positively endorsed by the Council. They are required where relevant through planning condition (LBRUT's AQ SPD 2020 S92). In 2024, there were 66 car club bays available to the operators Enterprise Car Club and Zipcar; however, some were unoccupied for a large part of the year due to residual demand issues and delays in supply of new vehicles caused by the global shortage of parts affecting manufacturing, primarily microchips. Consolidation of bays will take place in 2025.

					The council worked with Zipcar to launch the free-floating car club Zipcar Flex in the north of the borough from July 2021. In 2024 there were 28 vehicles available on average, more than 80% of which were electric. On average in the year there were 961 active members per month, making around 2,300 trips each month.
7.7	Cleaner transport	Tackle idling vehicles at schools as a priority	2020 ongoing	Local Authority Environmental Health and Parking	Traffic wardens target schools at pick up time on a regular basis. This continued throughout 2024. In 2023/4, active travel plans were encouraged and 15 school streets became permanent, encouraging more walking, scootering and cycling. This was considered a better option than targeting idling alone. However, traffic wardens and our Idling Action events, continued to regularly target roads around schools at collection time.
	New Projects for 2021	**Updates for 2024**			
7.8	Cleaner Transport	Participation in London E-scooter rental trial - June 2021 – May 2026	2026 ongoing	Local Authority Transport Team, TFL	LBRUT is one of the participating boroughs in the TfL London e-scooter rental trials. Over the first trial period from June 2020 to 24 September 2023, 3,186,487 trips were carried out by e-scooter across the London trial. The second phase of the trial began on 25 September 2023 and the trial has been extended to 31 May 2026. Not surprisingly hire of e-scooters is more popular summer to winter.

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>Below is a breakdown for the e-scooter trip data (to the nearest 100) for Richmond for Trial Period 2 – 25 September 2023 – 4 May 2025.
e-scooter trip data (to the nearest 100) for Richmond
Sept 2023- May 2025
<table><tr><th>Code</th><th>Trial period</th><th>Trips</th><th>Code</th><th>Trial period</th><th>Trips</th></tr><tr><td>P2TP1</td><td>25 Sep – 22 Oct 23</td><td>3113</td><td>P2TP12</td><td>29 Jul - 25 Aug 2024</td><td>1642</td></tr><tr><td>P2TP2</td><td>(23 Oct – 19 Nov 23)</td><td>2799</td><td>P2TP13</td><td>26 Aug - 22 Sep 2024</td><td>1868</td></tr><tr><td>P2TP3</td><td>20 Nov – 17 Dec 23</td><td>2990</td><td>P2TP14</td><td>23 Sept - 20 Oct 2024</td><td>1574</td></tr><tr><td>P2TP4</td><td>18 Dec – 14 Jan 24</td><td>2611</td><td>P2TP15</td><td>21 Oct - 17 Nov 2024</td><td>1698</td></tr><tr><td>P2TP5</td><td>15 Jan – 11 Feb 24</td><td>2921</td><td>P2TP16</td><td>18 Nov - 15 Dec 2024</td><td>1137</td></tr><tr><td>P2TP6</td><td>12 Feb – 10 Mar 24</td><td>2704</td><td>P2TP17</td><td>16 Dec 24 - 12 Jan 25</td><td>718</td></tr><tr><td>P2TP7</td><td>11 Mar – 7 Apr 24</td><td>2388</td><td>P2TP18</td><td>13 Jan - 09 Feb 2025</td><td>997</td></tr><tr><td>P2TP8</td><td>08 Apr - 5 May 2024</td><td>1948</td><td>P2TP19</td><td>10 Feb - 09 Mar 2025</td><td>1050</td></tr><tr><td>P2TP9</td><td>06 May - 2 Jun 2024</td><td>1497</td><td>P2TP20</td><td>10 Mar - 06 Apr 2025</td><td>1274</td></tr><tr><td>P2TP10</td><td>03 Jun - 30 Jun 2024</td><td>1614</td><td>P2TP21</td><td>07 Apr - 04 May 2025</td><td>1265</td></tr><tr><td>P2TP11</td><td>1 Jul - 28 Jul 2024</td><td>1726</td><td></td><td></td><td></td></tr></table>For more details see https://tfl.gov.uk/corporate/publications-and-reports/electric-scooter-rental-trial</td></tr>
<tr><td></td><td>New projects for 2022</td><td>Updates for 2024</td><td></td><td></td><td></td></tr>
<tr><td>1.9</td><td>Monitoring and other core statutory duties</td><td>Further Investment in new monitoring equipment as new technology moves forward.</td><td>2021
Ongoing in house</td><td>Local Authority Environmental Health, South London Partnership</td><td>2021, LBRUT won a joint bid for the ‘Internet of Things’ with the South London Partnership and by October 2021, had installed 45 x Breathe London air quality sensors to enhance NO_2 with real time monitoring and introduce real time PM2.5 monitoring borough wide. This meant for the whole of 2022 the Council had an additional 45 x real time air quality monitors.</td></tr>
</table>

					The project funding came to an end in Dec 2022 but the Council managed to continue funding in house. It had to reduce the number of sensors to 20 but continued with real time air quality monitoring. This meant throughout 2023 and 2024, all town centres and 10 schools had access to indicative, real time monitoring. In October 2024 the Breathe London contract expired, so Richmond arranged a temporary contract with the sensor provider Clarity. All data is available via Clarity OpenMap: https://map.clarity.io. This was a much sought after development by residents and members and is being used to help inform policy.
7.9	Cleaner transport	Cargo bike hire scheme	2022 ongoing	Local Authority Transport team	A Cargo Bike hire scheme was launched in May 2022, with three cargo bikes delivered to host-organisations in East Sheen, Hampton and Teddington. The Council funds the purchase and maintenance of these bikes. In August 2023, the Council delivered an additional 6 cargo bikes to serve Twickenham, Richmond Town Centre, Ham, St Margaret's, Whitton and Kew. In September 2024, the Council delivered another bike in Barnes. Richmond has the largest cargo bike hire network of this type in London. During 2024, the bikes have been hired 431 times by 371 active members and have covered 2485km, including 1888km that would have been travelled using vehicles fuelled by diesel or petrol. The scheme is delivered in partnership with Peddle My Wheels.
7.10	Cleaner transport	Dedicated parking bays for e-cargo bikes	2024 ongoing	Local Authority Transport and Parking teams	Progress is being made with the Council's plan to introduce dedicated parking bays for cargo bikes across the borough. In November 2021 the transport committee approved the designation of up to 25 cargo bike parking bays across

					Richmond. Officers secured funding and identified 10 locations where existing parking bays could be converted to dedicated cargo bike parking bays. Following discussions with ward councillors, officers are now finalising arrangements for local consultations and installation under an experimental traffic order for 12 months. Feedback will be monitored before a decision is made as to whether the bays are made permanent. Four locations were installed in September 2024 are as follows: Lowther Road, Wellesley Road, Stillingfleet Road and Ashburnham Road. These are all close to Primary Schools. An additional 8 parking bays are expected to be delivered in Spring 2025.
6.10	Localised solutions	Public realm improvements focused on enhancing pedestrian spaces	2023 ongoing	Local Authority Transport team	Construction on the A310 Strawberry Vale started in January 2022 and continued throughout 2023, as did the public realm focused project in East Twickenham. Throughout 2023 and 2024 a wider programme of public realm focused projects were also underway at various high streets across the borough, including Broad Street Teddington, Ham Parade, Hampton Wick and Castelnau Barnes. The projects are all focused on enhancing spaces for pedestrians, including the introduction of trees, plantings and SUDS.
3.12	Public health and awareness raising	Public Health's Air Pollution Action Plan - focus on targeting vulnerable groups and communities, providing information on health and air	2023 ongoing	Local Authority Public Health, NHS, Environmental Health	Awareness raising of the impact of air pollution on health was undertaken with regards to council and NHS staff via highlighting and supporting members to undertake the Making Every Contact Count (MECC) module. In total 52 people undertook this MECC training, who will now be able to disseminate information to patients and clients. In 2024

		pollution and raising awareness in the community			Public Health also undertook a behavioural insights project which engaged with a number of identified vulnerable groups (such as mothers with children, people with long-term health conditions) in air pollution hotspot areas. The project reviewed how much they knew of the link between air pollution and health as well as gain insights in terms of how organisations could better target messaging and provide health advice. The project also interviewed local GPs to find out their level of knowledge around air pollution and health. Findings suggested that both vulnerable groups and GPs had a good understanding of the impact of outdoor air pollution on health but little on indoor pollution. As a result of this the Richmond Air Quality Team has delivered a series of webinars for professionals including those from the health sector in 2025.
	New projects for 2023	**Updates for 2024**			
6.11	Localised solutions	Finalise Richmond Climate Risk Mapping, including vulnerability Score.Publish, and use the Richmond Climate Risk Mapping tool to identify vulnerable residents	2023 ongoing	Local Authority Climate Change	During 2023 Climate Risk Mapping developed to show social vulnerabilities and environmental hazards, for all areas of the borough at a Local Super Output Area (LSOA) level. This includes data on air quality related risks. This map has proved useful throughout 2024 and is available via DataRich https://www.datarich.info/climate-risk-map/

3.13	Public health and awareness raising	Continue role in development and delivery of SWL ICS Green Plan and contribute to the NHS Green Plan	2023 ongoing	Local Authority Climate Change , Public Health	Representatives from Public Health and Climate Change and Sustainability teams are part of the South West London Integrated Care Board Change and Sustainability Group, which is directing joined up health work on sustainability and the NHS' net zero targets. They are also part of the Green Plan working group, the sub-group which is shaping the development and delivery of the actions in the SWL ICB Green Plan. This has included leading sessions on Air Quality and health linkages, as well as sharing best practice examples
3.14	Public health and awareness raising	Implement actions in the Public Health Climate Change Action plan	2023 ongoing	Local Authority Climate Change , Public Health	The new Public Health Climate Change Action Plan was finalised in 2022/23. Several actions from this action plan have already been completed or were in progress during 2023 and 2024, including: • Training: the MECC (Making Every Contact Count) module on climate change and health was finalised in mid-2023 and presented at and shared with the Climate Change Public Health London Network, VCS networks and at the SWL ICB NHS Green Plan Delivery Group. • Communication and Engagement: a Public Health Engagement and Communications plan has been developed; climate change workshops have been delivered; climate change briefs for the community voluntary sector have been developed and circulated; the Council website has been updated with climate change and health information; and participated in Clean Air Day, Car Free Day, and the Big Green Week. • Adaptation: formation of heatwave and vulnerable population working group; drafting of the Heatwave Health

					Needs Impact Assessment report (in consultation); leading on Severe Weather Planning; and continuing to be a core member of the Borough Resilience Forum and the SSA Resilience Planning group and regularly contributes to corporate emergency plans. • Influencing strategies, policies and plans: contributed to the development of the Local Plan, Walking and Cycling Strategy, Prevention Framework, and GLA Super Zone Programme. • Public Health Divisional Management Team coversheet has been updated to include guidance and support to help Public Health officers identify links to their papers (policies, strategies, plans, procurements, commissioning plans and reports) to climate change and air quality.
	New projects for 2024				
6.12	Localised solutions	Use data to adapt to a changing climate and increase the resilience of the borough	2025	Local Authority Climate Change , Public Health, SWLICS, Environmental Health	In 2024 the Climate Change team engaged with various stakeholders inside and outside the Council for the benefit of the Climate Change and Air Quality agenda. In summary it will: Continue to use the Climate Risk Mapping tool to identify adaptation and resilience priorities and finalise Phase 2 of the Climate Risk Mapping tool, including new layers and features Scope how different in-house mapping tools and platforms can be used to ensure a more joined-up approach to work across the Council, including

					mapping of existing public refuges accessible during extreme weather events. Ensuring a joined-up approach to adaptation and resilience Work with the teams across the Council to identify and bid for funding opportunities for adaptation and resilience work Continue and expand partnership working with external stakeholders to identify potential opportunities for collaborative working, including contributing to the development of the London Surface Water Strategy and working with the pan London Resilient and Green programme Implement actions in the Public Health climate action plan including raising awareness of the health risks of climate change in high climate risk areas and populations and continue progress against the climate change step in the Joint Health and Wellbeing Strategy Collaborate across the South West London Integrated Care System in the development and delivery of the local NHS Green Plan, supporting actions on engagement and education about air quality and health, as well as adaptation and resilience for health providers and residents Working in collaboration with West London boroughs, deliver improved communication, engagement and community resilience building for extreme heat events Monitoring and evaluation of adaptation and resilience

					Develop indicators for monitoring and evaluation of climate adaptation and resilience projects and infrastructure Scope options for undertaking a cost-benefit analysis of climate impacts, adaptation and resilience.

3. Planning Update and Other New Sources of Emissions

3.1 Planning Update

Table N. Planning requirements met by planning applications in the London Borough of Richmond upon Thames in 2024

Condition	Number
Number of planning applications where an air quality impact assessment was reviewed for air quality impacts	22
Number of planning applications required to undertake construction dust monitoring and reporting (Please specify how you get access to dust monitoring data i.e. online tool or CSV file)	5 Requested by email from planning officer
Number of CHPs/Biomass boilers refused on air quality grounds	0
Number of CHPs/Biomass boilers subject to GLA emissions limits and/or other restrictions to reduce emissions as detailed in Air Quality Neutral LPG (london.gov.uk) point 3.1.5.	0
Number of developments required to install Ultra-Low NO_X boilers	22 (all 22 likely to install non combustion)
Number of developments where an AQ Neutral building and/or transport assessments undertaken	21
Number of developments where the AQ Neutral building and/or transport assessments not meeting the benchmark and so required to include additional mitigation	5
Number of planning applications with S106 agreements including other requirements to improve air quality	2
Number of planning applications with CIL payments that include a contribution to improve air quality	0
NRMM: Central Activity Zone, Canary Wharf and Opportunity Areas Number of planning applications with conditions related to NRMM included. Number of developments registered at www.nrmm.london. Number of audits (based on the pan-London project report and / or inhouse auditing programme) % of sites unregistered prior to audit % of sites compliant with Stage IV of the Directive and/or exemptions to the policy.	N/A
NRMM: Greater London (excluding Central Activity Zone, Canary Wharf and Opportunity Areas) Number of planning applications with conditions related to NRMM included. Number of developments registered at www.nrmm.london. Number of audits (based on the pan-London project report and / or inhouse auditing programme)% of sites unregistered prior to audit	22 conditions included 14 registered 16 audits

Condition	Number
% of sites compliant with Stage IIIB of the Directive and/or exemptions to the policy.	87.5% (14) sites compliant

LBRuT received no applications for use of CHP/biomass in 2024, which have been actively discouraged. Consultants and developers are more often proposing non-combustion, ASHP, maximum insulation and renewables to increase BREEAM ratings and only occasionally request ultra low NOx boilers, which are now discouraged. District heat networks are flagged for larger developments but to date have proved inefficient, usually due to distance. Requirements are as per London Plan, which meant none could be refused on grounds of AQ in 2024, although mitigation was required.

3.2 New or significantly changed industrial or other sources

No new sources identified.

4. Additional Activities to Improve Air Quality

4.1 London Borough of Richmond upon Thames Fleet

The London Borough of Richmond upon Thames has a relatively small fleet; it has no Council housing; Waste and Recycling and Parks are contracted out.

By Dec 2024 LBRUT had 73 vehicles, 71 (97.2%) are Euro VI, 1 x hybrid (1.4%) and 1 x EV (1.4%) zero emission.

Issues around the installation of EVCP at the Council depot have hampered fleet upgrades which are hoped to be resolved shortly. Updates will be provided in ASR 2026.

4.2 Planning Enforcement

NRMM is a standard planning condition applied to all major developments. All sites are requested to register on the NRMM website and all NRMM used on-site is compliant with Stage IV of the Directive and/or exemptions to the policy. In 2023 and again in 2024, the Principal Air Quality Officer emailed current NRMM conditions to the Head of Planning and ensured all Planning Officers were reminded of requirement to add NRMM to all planning applications.

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 national, Mayoral and LBRUT local policies are applied by Environmental Health to all responses to Planning in all cases. Sites are considered for construction dust on a case-by-case basis, monitoring required and locations agreed between EH, Planning Officers and the developer pre to commencement of any work on site, where a moderate or high risk to receptors is predicted. Any complaint is investigated, mitigation agreed and additional dust suppressant systems required where necessary. This is carried out largely by EH and where necessary by Planning Enforcement.

The RSP (LB Merton, LBRUT and LB Wandsworth) have 6 designated Officers based in Merton, who assess all major sites for NRMM compliance, visit sites and check the NRMM database for compliance in line with the Mayors Supplementary Planning Guidance for Control of Dust and Emissions during Construction and Demolition.

4.3 Pan-London NRMM Auditing Project

The London Borough of Richmond upon Thames is continuing to support the pan-London NRMM auditing project in 2025-2026.

The standard wording for NRMM conditions is:

"All Non-Road Mobile Machinery (NRMM) of net power of 37kW and up to and including 560kW used during the course of the demolition, site preparation and construction phases shall comply with the emission standards as published on the NRMM Website (Non-Road Mobile Machinery (NRMM) | London City Hall) Unless it complies with the standards set out on the website, no NRMM shall be on site, at any time, whether in use or not, without the prior written consent of the local planning authority. The developer shall keep an up to date list of all NRMM used during the demolition, site preparation and construction phases of the development on the online register.

All NRMM should be regularly serviced and service logs kept on site for inspection. Records should be kept on site which detail proof of emission limits for all equipment. The development shall be constructed in accordance with the approved details. All sites will be inspected for compliance."

The wording is provided by the Air Quality Officer to the Planning Officer and is applied to all major planning applications by them. It is generally included in the Construction Management Plan/Environmental Management Plan which is discharged by EH, usually by the original Air Quality Officer.

This is applied to all major construction sites.

4.4 Air Quality Alerts

The London Borough of Richmond upon Thames continues to support *air*TEXT (https://www.airtext.info/) and the Mayor of London's air quality alert programme run by Imperial College London, which sends alerts to all schools, GP surgeries and care homes in LBRUT. Advice is based on Defra's national Daily Air Quality Index

4.5 Air Quality Positive

The London Borough of Richmond upon Thames has no innovative mitigation measures committed as part of a submitted Air Quality Positive Matrix which aligns with the Air Quality Positive London Plan Guidance.

Appendix A Details of Monitoring Site Quality 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. Continuous automatic monitoring was conducted throughout the entire 12-month period in 2024.

NO_2 Monitoring

Each NO_2 chemiluminescent continuous analyser is checked regularly online by Imperial College London and calibrated by the newly appointed contractor, We Care 4 Air (WC4A), (appointed on 1st April 2024) employed by LBRuT for Local Support Officer (LSO) and Service and Maintenance visits during 2024. Regular 4 weekly calibration visits were maintained throughout 2024.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%. This avoids the less precise permeation tube method.

In 2024 the NO_2 and ozone continuous analysers were serviced every six months by WC4A and audited by Ricardo every six months. The National Physical Laboratory (NPL), who the Council has employed to do this for over 20 years, no longer provides this service. This forms part of Environmental Research Groups (ERG) - Imperial College London's, London Air Quality Network (LAQN) QA/QC procedure, to ensure optimum data quality.

Teddington (AURN) monitoring station at NPL is part of the AURN and AEA Technology manages the QA/QC for this station. For more information go to https://uk-air.defra.gov.uk.

PM_{10} Monitoring Adjustment

PM_{10} 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 remotely assessed checked online, by the Duty Officer of the Environmental Research Group (ERG) Imperial College London Ricardo. The role of the LSO at the 4 weekly 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 Imperial College London, prior to dissemination of the data.

The TEOM equipment is serviced every six months by WC4A and also audited by Ricardo every six months as part of Imperial's LAQN QA/QC procedure, to ensure optimum data quality. Both sites are part of the LAQN and Imperial are responsible for the daily data collection, storage, validation and dissemination via the LAQN website (www.londonair.org.uk). Imperial ratifies the data periodically, viewing data over longer time periods and using the results from 4 weekly checks, equipment services and equipment audits.

In 2024 measured mean PM_{10} concentration for both LBRuT's automatic monitoring sites was 16 µg m^{-3} for Castlenau and 15 µg m^{-3} for Wetlands, achieving data capture rates of 99% and 84% respectively. Since neither site fell below the Defra required 75% data capture threshold "annualisation" of data was not necessary. (This is in accordance with the procedure detailed in LLAQM Technical Guidance (TG19)). Details are in Appendix A Table P.

A.2 Diffusion Tubes

Laboratory supplying diffusion tubes 2024

The laboratory supplying diffusion tubes to LBRUT throughout 2024 (and in the preceding 20 years plus) was Gradko International Ltd. All Richmond NO_2 diffusion tubes are prepared by Gradko using 50% v/v TEA with Acetone as the absorbent.

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.

To prevent premature absorption, an opaque polythene cap is placed over the end of the diffusion tube opposite the TEA-coated discs before and after sampling. The tubes are labelled and stored in plastic bags, refrigerated, both prior to and after exposure.

In the laboratory, the steel mesh is removed and washed with distilled water, which is then analysed. The concentration of nitrogen dioxide is determined by passing ultraviolet (UV) light through the water sample. The amount of light absorbed correlates to the concentration of nitrogen dioxide present in the air during the monitoring period.

Performance criteria QA/QC

Directive 2008/50/EC of the European Parliament and of the Council on ambient air quality and cleaner air for Europe (EC, 2008), now adopted into UK law, 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.

To ensure high-quality NO_2 concentration data, it is essential to meet stringent performance criteria through comprehensive quality assurance (QA) and quality control (QC) procedures. Several factors influence the performance of NO_2 diffusion tubes, including the laboratory conducting the analysis and the method used to prepare the tubes (AEA, 2008). As such, QA and QC procedures are a fundamental part of any monitoring programme, minimizing data uncertainties and ensuring the most accurate estimate of true concentrations.

Our NO_2 diffusion tubes are analysed by Gradko, using the 50% TEA in acetone preparation method. Gradko actively contributes to the development of rigorous QA and QC procedures to maintain the highest level of confidence in their laboratory measurements. They played a key role in the creation of the Harmonisation Practical Guidance for NO_2 diffusion tubes (AEA, 2008) and have adhered to these guidelines since January 2009. Additionally, since April 2014, Gradko has participated in the AIR-PT scheme, which combines two long-established proficiency testing schemes: the LGC Standards STACKS PT scheme and the HSL WASP PT scheme.

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

Performance in Air NO_2 PT Scheme (February 2023 to February 2025)
Summary of Precision Scores for 2023-2025
United Kingdom Accreditation Service (UKAS) schedule of accreditation (December 2024)

Gradko International Ltd is a UKAS-accredited laboratory that actively participates in laboratory performance and proficiency testing schemes. These schemes establish rigorous performance standards for participating laboratories, ensuring that the reported NO_2 concentrations are of the highest quality.

Summary of Laboratory Performance in AIR NO_2 Proficiency Testing Scheme (February 2023 to February 2025)

Gradko participates in the AIR-PT scheme for NO_2 diffusion tube analysis, which involves the quarterly testing of laboratory performance using artificially spiked diffusion tubes. This scheme is designed to help laboratories meet the requirements of the European Standard. In 2024, Gradko demonstrated **satisfactory** performance for the 50% TEA in acetone preparation method.

The laboratory adheres to the procedures outlined in the *Harmonisation Practical Guidance* and is an active participant in the AIR-PT proficiency testing scheme. Prior to AIR-PT, Gradko took part in the Workplace Analysis Scheme for Proficiency (WASP) for NO_2 diffusion tube analysis. DEFRA and the Devolved Administrations recommend that diffusion tubes used for Local Air Quality Management (LAQM) should be sourced from laboratories that have shown consistent, satisfactory performance in the AIR-PT scheme.

Gradko's laboratory performance is further evaluated by the National Physical Laboratory (NPL), which assesses results from the AIR-PT scheme in conjunction with data from the monthly NPL Field Inter-Comparison Exercise, conducted at Marylebone Road in central London. Laboratories are assigned a ‘z’ score, where a score of ±2 or less indicates satisfactory performance. Gradko International Ltd.’s performance in 2024 is covered under AIR-PT rounds AR062 to AR068.

Based on the latest available data, the five-round performance window used to evaluate Gradko's laboratory quality spans AIR-PT rounds AR055 to AR068. Details of the scheme can be found at: https://laqm.defra.gov.uk/wp-content/uploads/2022/07/LAQM-NO2-Performance-data_Up-to-June-2022_V2.1.pdf

During this time, 100% of the results submitted by Gradko were determined to be satisfactory other than the results for Jan-Feb 2025.

Table 1: Laboratory summary performance for AIR NO_2 PT rounds AR055, 56, 58, 59, 62, 63, 65, 66 and 68

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 ≤ ± 2 as defined above.

AIR PT Round	AIR PT AR055	AIR PT AR056	AIR PT AR058	AIR PT AR059	AIR PT AR062	AIR PT AR063	AIR PT AR065	AIR PT AR066	AIR PT AR068
Round conducted in the period	January – February 2023	May – June 2023	July – August 2023	September – October 2023	January – February 2024	April – June 2024	July – August 2024	September – October 2024	January – February 2025
Aberdeen Scientific Services	0 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %	100 %
Cardiff Scientific Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Edinburgh Scientific Services	100 %	75 %	100 %	50 %	100 %	100 %	100 %	100 %	100 %
SOCOTEC	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	100 % [1]	87.5 % [1]
Exova (formerly Clyde Analytical)	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Glasgow Scientific Services	100 %	100 %	100 %	100 %	75 %	100 %	100 %	100 %	100 %
Gradko International	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	50 %
Kent Scientific Services	NR [3]	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]	NR [3]
Lambeth Scientific Services	0 %	75 %	50 %	0 %	50 %	50 %	50 %	50 %	100 %
Milton Keynes Council	50 %	75 %	100 %	100 %	100 %	NR [2]	50 %	100 %	100 %
Northampton Borough Council	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]
Somerset Scientific Services	100 %	75 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
South Yorkshire Air Quality Samplers	NR [2]	NR [2]	NR [2]	NR [2]	NR [2]	NR [2]	NR [2]	NR [2]	NR [2]
Staffordshire County Council, Scientific Services	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
Tayside Scientific Services (formerly Dundee CC)	NR [2]	100 %	NR [2]	NR [2]	NR [2]	NR [2]	100 %	NR [2]	NR [2]
West Yorkshire Analytical Services	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]	NR [3]

[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] Cardiff Scientific Services, Exova (formerly Clyde Analytical), Kent Scientific Services, Kirklees MBC, Northampton Borough Council and West Yorkshire Analytical Services; no longer carry out NO2 diffusion tube monitoring and therefore did not submit results.

Precision Summary Results

The summary of diffusion tube precision results is provided below, outlining the total number of good and bad precision results over the past three years for laboratories currently conducting diffusion tube analysis. Details of the scheme can be found at: https://laqm.defra.gov.uk/air-quality/air-quality-assessment/precision-and-accuracy/

2022 - 2024 Summary of Precision Results for Nitrogen Dioxide Diffusion Tube Collocation Studies UK Laboratories including for Gradko Laboratory 50% TEA in Acetone

Precision Summary Table

Diffusion Tube Preparation Method	2022 Good	2022 Bad	2023 Good	2023 Bad	2024 Good	2024 Bad
Gradko, 50% TEA in Acetone	16	0	16	0	11	0
Gradko, 20% TEA in Water	33	0	25	0	26	0
ESG Didcot / SOCOTEC, 50% TEA in Acetone	29	0	33	2	30	3
ESG Didcot / SOCOTEC, 20% TEA in Water	11	0	8	0	1	0
Staffordshire Scientific Services	13	0	12	0	16	0
Glasgow Scientific Services	3	3	1	0	1	0
Edinburgh Scientific Services	1	0	4	2	1	1
Milton Keynes Council	1	0	1	0	1	0
Tayside Scientific Services	1	0	1	0	1	0
Lambeth Scientific Services	6	4	10	1	2	0
Aberdeen Scientific Services	7	0	7	0	6	0
ESG Glasgow, 50% TEA in Acetone	1	0	1	0	1	0
ESG Glasgow, 20% TEA in Water	1	0	1	0	1	0
Somerset County Council	14	0	12	0	4	0

Numerical results for this data are contained in the National Bias Adjustment Spreadsheet version 04/25

Numerical results for this data are contained in the National Bias Adjustment Spreadsheet version 04/25. In 2024, the tube precision for NO_2 Annual Field Inter-Comparison for Gradko International using the 50% TEA in acetone method was 'good' for the results of 11/12 participating local authorities, no participating local authorities were deemed to be 'bad'.

Analysed By	Method	Year	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m³)	Automatic Monitor Mean Conc. (Cm) (µg/m³)	Bias (B)	Tube Precision	Bias Adjustment Factor (A) (Cm/Dm)
Gradko	50% TEA in Acetone	2024	UB	City Of London Corporation	10	26	21	26.8%	G	**0.79**
Gradko	50% TEA in Acetone	2024	R	City Of London Corporation	12	34	30	12.1%	G	**0.89**
Gradko	50% TEA in Acetone	2024	UB	Falkirk Council	11	13	13	-1.6%	G	**1.02**
Gradko	50% TEA in acetone	2024	SU	Redcar And Cleveland Borough Council	12	12	9	35.4%	G	**0.74**
Gradko	50% TEA in acetone	2024	KS	Marylebone Road Intercomparison	11	43	36	20.8%	G	**0.83**
Gradko	50% TEA in acetone	2024	R	Sandwell Mbc	12	30	25	24.2%	G	**0.81**
Gradko	50% TEA in acetone	2024	UB	Sandwell Mbc	12	19	17	8.0%	G	**0.93**
Gradko	50% TEA in acetone	2024	R	Sandwell Mbc	12	20	20	-2.6%	S	**1.03**
Gradko	50% TEA in Acetone	2024	R	London Borough Of Merton	12	27	22	25.7%	G	**0.80**
Gradko	50% TEA in acetone	2024	UB	London Borough Of Wandsworth	10	19	14	31.7%	G	**0.76**
Gradko	50% TEA in acetone	2024	R	London Borough Of Richmond Upon Thames	12	18	19	-9.1%	G	**1.10**
Gradko	50% TEA in acetone	2024	B	London Borough Of Richmond Upon Thames	12	13	13	5.0%	G	**0.95**
Gradko	50% TEA in acetone	2024		**Overall Factor[3] (12 studies)**				**Use**		

Schedule of Accreditation issued by United Kingdom Accreditation Service (UKAS)

Gradko is UKAS-accredited for the analysis of NO_2 diffusion tubes, utilising ultra-violet spectrophotometry for the analysis of exposed tubes. The relevant test is outlined in the UKAS Schedule of Accreditation, issued on 23 December 2024 which is provided on the next page.h

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

2187

Accredited to ISO/IEC 17025:2017

Gradko International Ltd
(Trading as Gradko Environmental)

Issue No: 027 **Issue date:** 23 December 2024

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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

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Accredited to ISO/IEC 17025:2017

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

Gradko International Ltd
(Trading as Gradko Environmental)

Issue No: 027 Issue date: 23 December 2024

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)	<u>Chemical Tests</u> (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 Tetrachloroethylene Trichloroethylene Styrene 1,2,4-Trimethylbenzene 1,3,5-Trimethylbenzene Chlorobenzene 1,2-Dichlorobenzene 1,3-Dichlorobenzene 1,4-Dichlorobenzene	GLM 13-1 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
	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

Factor from Local Co-location Studies

Excluding 2024, LBRUT, where possible, favour using a local roadside correction factor for kerbside/roadside sites and a local background correction factor for background sites, so for ease of understanding, we are not providing bias adjustment factors for previous years in the body of the report. Please see the local bias adjustment factors for the Borough in Table O for 2017 to 2024.

Diffusion Tube Bias Adjustment Factors from Local Co-location Studies

In 2024, the Borough undertook co-location studies at two continuous NO_2 monitoring sites, with triplicate NO_2 diffusion tubes at the following the locations:

Richmond 1 Castelnau: a roadside site, in Castlenau Library Barnes. In 2024, the annual means for the Castelnau diffusion tubes **(sites 23, 23/2 and 23/3)** was 15.5 µg $m^{-3,}$ for the continuous site (RI1) it was 19.2 µg m^{-3}. **The bias adjustment factor is 1.1**

Richmond 2 Barnes Wetlands: a suburban background site at the Wetland Centre in Barnes SW13.

In 2024, the annual means for the Wetlands diffusion tubes **(sites 37, 37/2 and 37/3)** was 11.7 µg m^{-3}; for the continuous site (RI2) it was 12.3 µg m^{-3}. **The bias adjustment factor is 0.95**

Data capture for 2024 was excellent at Castlenau, achieving 100% and good at Wetlands achieving 86%..

All LBRUT data was completed and returned in time for the co-location questionnaire and is included in the database bias adjustment factors v 03/24.

In 2024 we witnessed a larger discrepancy in local to national bias adjustment factor for Gradko 50% TEA than had been witnessed in earlier years. This prompted a significant analysis of all data and a review of the literature.

This resulted in the selection of the national bias adjustment factor of 0.88 being selected to adjust all the data. Please see below “Discussion of Choice of Factor to Use” and Appendix E for detailed analysis.

Discussion of Choice of Factor to Use

In all previous years, where data capture permitted, we have employed a local bias correction factor and /or the most conservative bias correction factor between local and national bias adjustment factor for Gradko using the 50% TEA in acetone methodology. Choice of bias adjustment factor is always given very careful consideration but 2024 proved extremely challenging for LBRUT due to the large discrepancy between local and national bias adjustment factors in 2024. This presented us with a huge dilemma, so much time and resources were spent finding a justifiable solution.

It should be noted that we wish to neither underestimate or over report levels of NO_2 in the borough.

The National bias adjustment factor for Gradko using 50% TEA in acetone for March 2024 (v03/24) was 0.88. The Castlenau roadside site was 1.1 and the Wetlands background site was 0.95. Data capture at Caslenau was excellent at 100% and at Wetlands was good at 86%. Throughout 2024, data for the analysers had been regularly checked by Imperial College London and a new contractor had been employed to provide routine calibrations and service and maintenance. Both sites had been audited in a timely and thorough way by Ricardo. Nothing throughout the year threw up any concerns.

Luckily Richmond is part of the RSP – Regulatory Services Partnership - covering LBRuT, LB Merton and LB Wandsworth. This gave us 5 highly experienced and qualified officers (with a PhD in atmospheric chemistry and more than 120 years of air quality experience between them) to work through the data and consider all options. We also consulted the LAQM helpdesk, the GLA and NPL. Much work ensued, probably digging deeper into laboratory testing than has been done for many years. In summary a review of the literature suggested the primary purpose of diffusion tube bias adjustment is correction for laboratory technique variations. For the type of diffusion tube doping used by the RSP, seasonal variability or trends in the bias stats would not be expected but was evident at two of the three RSP sites. Further work should be conducted to investigate the source of these sustained biases, and consideration given as to whether diffusion tubes statistics for 2023 and 2024 should be corrected based on national correction factors instead of local. The wider question of local corrections based on administrative boundaries also deserves closer study.

For the purposes of this report we considered applying the more conservative local bias correction factor of 1.1 for local roadside sites, applying the more conservative local bias correction factor of 0.95 for local background sites, applying the national Gradko bias correction factor of 0.88 for either/both, or as we have done in the past, averaging our roadside and back ground sites. We even considered averaging the London roadside sites, that had used Gradko 50% TEA in acetone and had contributed to the national bias correction survey for the roadside sites. After much serious deliberation we decide to follow the advice of both the LAQM heldesk, the GLA and our own opinions and apply the national Gradko bias correction factor. It is well understood that applying the national Gradko bias correction factor of 0.88 will result in less conservative results. However, we could not ignore the sustained biases in the local data and this was considered the more robust option. A summary report is given at appendix E. We will continue our investigations and may carry out comparative testing using other laboratories or other tube preparation methods.

Table O. Bias Adjustment Factor

Year	Local or National	If Local, Version of National Spreadsheet	Adjustment Factor Roadside	Adjustment Factor Background
2024	National	03/24	0.88	0.88
2023	Local	03/24	0.86	0.86
2022	National	03/23	0.82	0.82
2021	Local	03/22	0.87	0.83
2020	Local	03/21	0.91	0.83
2019	Local	03/20	0.9	0.99
2018	National	03/19	0.92	0.93
2017	National	03/18	0.97	1

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% and greater than 25% of a full calendar year (between 3 and 9 months), the mean of the 'raw' concentrations should be "annualised" i.e. adjusted using the methodology outlined in LLAQM Technical Guidance (TG19) before being compared to annual mean objectives. In 2024 data capture at all automatic and non-automatic (diffusion tube) NO_2 sites was very good and above 75% so this was not necessary.

Table P. Non-Automatic Monitoring Data Adjustment ep

Measured mean NO_2 concentration for all non-automatic monitoring sites for 2024 was very good based on all sites achieving data capture rates of more than 85%. Since this was above the 75% data capture threshold required by Defra "annualisation" of data was not necessary. (This is in accordance with the procedure detailed in LLAQM Technical Guidance (TG19)).

Table P has therefore been deleted.

Table Q. Automatic NO_2 Monitoring Data Adjustment

Measured mean NO_2 concentration for both Castlenau and Wetlands automatic monitoring sites for 2024 was 19 µg m^{-3} and 12 µg m^{-3} respectively based on data capture rates of 100% and 86%. Since this was above the 75% data capture threshold required by Defra "annualisation" of data was not necessary. (This is in accordance with the procedure detailed in LLAQM Technical Guidance (TG19)).

Table Q has therefore been deleted.

Table R. Automatic PM_{10} Monitoring Data Adjustment

Measured mean PM_{10} concentration for both Castlenau and Wetlands automatic monitoring sites for 2024 was 16 µg m^{-3} and 15 µg m^{-3} respectively based on data capture rates of 99% and 84%. Since this was above the 75% data capture threshold required by Defra "annualisation" of data was not necessary. (This is in accordance with the procedure detailed in LLAQM Technical Guidance (TG19)).

Table R has therefore been deleted.

Table S. Automatic PM2.5 Monitoring Data Adjustment

Measured mean PM2.5 concentration results were not available at any site for 2024.

Annualisation was therefore not possible and

Table S has therefore been deleted.

Distance Adjustment

Where an exceedance is measured at a monitoring site which is not representative of public exposure, the procedure specified in LLAQM.TG(19) to estimate the concentration at the nearest receptor has been deployed.

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 has been bias adjusted using the background concentration value of 12.3 µg m^{-3} for Wetlands which achieved a data capture rate of 86% for 2024 above the 85% required by Defra as per LLAQM (TG19) guidance.

Distance correction was completed for 3 locations where the annual mean was above 36 µg m^{-3}. Following distance correction 1 location exceeded 36 µg m^{-3} at the receptor and 2 locations were below 36 µg m^{-3} at the receptor which is within 10% of the AQS (Air Quality Standard).

Results are reported in **Table T** below**.**

Table T. NO_2 Fall off With Distance Calculations

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted (µg m^{-3})	Background Concentration (µg m^{-3})	Concentration Predicted at Receptor (µg m^{-3})
36	2.1	4.3	**45.3**	12.3	**44.9**
42	0.7	3.6	36.6	12.3	32.0
Rut 02	0.7	2.9	36.0	12.3	30.9

Appendix B Full Monthly Diffusion Tube Results for 2024

Table U. NO_2 2024 Diffusion Tube Results ($\mu g\ m^{-3}$)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted	Annual Mean: Distance Corrected to Nearest Exposure	Comment
1	515824	168815	19.6	18.5	19.6	13.0	16.1	16.6	15.7	16.9	18.9	21.5	23.5	20.1	18.3	16.1		
2	513217	169746	25.7	20.3	18.4	13.5	17.2	16.8	15.7	14.9	18.2	23.2	25.1	16.8	18.8	16.5		
4	514607	171258	30.9	21.0	22.4	16.7	23.0	22.2	21.6	17.2	24.0	30.8	35.4	22.5	24.0	21.1		
7	515695	170983	31.8	27.3	26.2	22.1	32.2	29.6	25.0	29.3	37.9	34.8	37.2	26.3	30.0	26.4		
9	514846	172348	27.2	19.3	21.1	14.7	17.8	17.4	15.7	15.9	20.7	23.1	29.6	18.3	20.1	17.7		
10	513390	172233	33.5	33.5	25.2	23.0	25.4	27.2	20.8	26.3	26.0	30.2	29.1	30.6	27.5	24.2		
11	514136	173389	31.1	23.9	21.8	17.7	20.6	16.2	15.4	18.3	22.9	25.5	32.6	23.6	22.5	19.8		
12	512612	173439	29.8	25.1	23.8	20.2	22.5	20.0	19.3	20.3	24.8	27.3	28.2	20.6	23.5	20.7		
13	515228	174082	23.7	21.7	23.6	16.4	16.9	16.5	15.9	19.0	22.6	26.9	29.1	21.3	21.1	18.6		
15	517196	173933	23.0	22.7	23.5	13.7	20.6	21.3	18.9	17.9	24.5	24.3	27.1	22.4	21.7	19.1		
17	517822	174755	34.6	28.9	26.6	24.4	27.9	30.4	25.8	19.0	33.0	32.1	31.1	25.2	28.2	24.9		
18	518822	175590	34.5	36.3	26.6	30.1	33.7	32.9	28.7	30.7		30.3	35.6	25.8	31.4	27.6		
19	518643	176156	24.5	27.5	28.9	20.6	20.6	18.4	18.5	19.1	18.6	24.7	30.8	19.5	22.6	19.9		
20	519205	177221	35.0	29.2	30.2	23.3	30.5	25.8	25.9	23.3	25.5	29.8	37.8	24.9	28.4	25.0		
22	522853	177908	26.4	21.4	19.1	11.5	13.7	11.5	11.8	11.8	16.4	20.0	23.3	20.4	17.3	15.2		
23	522502	177166	24.5	18.2	19.9	14.3	16.8	13.2	14.0	12.6	16.3	20.1	24.7	17.0	17.6	15.5		Triplicate mean
26	519168	175055	35.4	26.7	32.0	24.5	29.0	28.1	25.3	30.4	31.1	31.1	38.5	28.2	30.0	26.4		
28	519445	173991	15.9	10.3			10.1	7.7	7.2	7.4	11.1	12.4	16.0	11.6	11.0	9.7		
30	518022	173165	26.3	19.5	19.9	12.3	19.1	15.9	15.3	14.8	18.5	22.6	25.6	17.7	19.0	16.7		
31	515434	174045	33.2	30.7	30.4	22.3	27.1	28.8	26.8	30.4	30.9	40.0	39.6	33.8	31.2	27.4		
32	516226	173195	30.5	33.2	32.0	23.7	29.8	29.4	27.4	30.1	28.6	36.0	37.9	24.5	30.3	26.6		
33	515934	173126	36.0	23.0	27.5	25.4	27.5	28.2	23.0	23.4	31.4	28.3	36.2	25.6	28.0	24.6		
35	517524	169583	28.5	23.2	22.9	18.3	18.9	19.8	19.3	18.2	19.7	23.8	29.0	24.5	22.2	19.5		
36	520540	175399	46.0	50.2	54.3	43.4	53.3	51.2	52.0	52.8	53.5	55.2	54.7		**51.5**	**45.3**	**44.9**	
37	522993	176731	19.6	13.5	13.8	9.2	11.4	9.2	9.7	10.6	13.4	15.7	20.2	13.6	13.3	11.7		Triplicate mean
39	517516	174331	40.2	34.0	26.8	30.0	32.4	33.4	31.6	31.7	40.5	34.0	37.4	32.7	33.7	29.7		
40	514068	172435	29.2	25.1	22.9	17.8	22.4	21.3	17.7	16.4	21.5	21.2	29.5	24.5	22.5	19.8		
42	518080	175259	41.1	42.5	45.0	38.1	38.9	41.9	39.7	40.2	43.9	43.4	47.3	37.9	41.6	36.6	32.0	
43	517759	174757	42.9	38.5	39.1	34.0	40.2	39.1	38.3	37.2	39.8	40.9	42.4	31.8	38.7	34.0		
44	518489	175056	35.9	33.5	28.2	21.8	28.4	28.4	25.2	28.8	32.0	32.0	40.9	26.2	30.1	26.5		
45	516383	171154	25.2	21.3	17.4	14.0	18.0	15.8	16.4	17.9	20.0	22.6	23.9	20.2	19.4	17.1		

50	519922	175324	42.5	34.3	40.9	34.7	38.8	39.4	37.4	35.9	45.5	38.6	42.0	33.0	38.6	33.9		
51	520492	175695	25.5	21.7	20.7	16.0	19.2	17.7	16.7	16.1	21.4	24.9	31.3	18.1	20.8	18.3		
52	519773	175795	40.4	41.5		28.7	32.7	36.3	35.0	33.6	40.7	36.2	40.2	36.8	36.6	32.2		
55	519793	176142	33.1	23.3	25.9	18.7	22.0	20.5	21.2	20.7	23.3	26.2	32.4	21.5	24.1	21.2		
56	516788	174519	22.8	21.6	18.8		19.8	21.2	16.9	14.6	23.4	23.4	30.9	20.8	21.3	18.7		
57	513915	172899	32.0	21.7	22.2	15.6	21.9	20.8	17.7	17.2	23.3	24.2	32.7		22.7	19.9		
58	516039	173766	29.7	21.2	27.5	16.9	21.8	19.7	18.1	19.3	20.6	23.1	31.8	19.7	22.4	19.7		
62	521651	176430	30.8	22.1	24.7	18.0	24.1	23.4	20.9	18.9	26.8	28.3	32.2	19.8	24.2	21.3		
63	514188	173801	32.9	23.0	24.6	21.5	23.1	21.6	19.1	21.1	23.1	26.6	31.5	23.6	24.3	21.4		
64	514484	171251	34.3	24.4	21.5	25.0	26.8	26.7	22.5	22.2	27.5	28.9	31.2	24.0	26.2	23.1		
65	516339	173366	35.8	37.2	38.4	30.1	28.5	32.8	32.3	33.8	34.1	37.8	43.2	31.8	34.6	30.5		
66	519060	177428	25.8	30.4	26.8	20.8	26.0	27.1	25.5	23.3	25.5	29.0	35.9	25.3	26.8	23.6		
67	518042	174095	25.4	19.8	22.1	13.4	18.8	16.1	14.8	15.1	17.4	21.0	27.2	23.3	19.5	17.2		
68	522415	176537	31.1	27.1	25.8	21.9	24.2	26.2	23.0	22.3	24.6	27.0	30.5	20.1	25.3	22.3		
69	513494	171729	24.6	20.4	17.9	18.0	15.9	15.4	15.0	14.8	21.9	22.8	28.1	19.4	19.5	17.2		
70	520465	175965	34.6	33.0	33.2	24.3	29.4	29.6	23.6	24.4	31.7	34.0	38.7	26.1	30.2	26.6		
71	516574	174456	36.8	35.5	35.3	29.0		32.3	30.6	33.9	28.6	31.3	34.4	25.6	32.1	28.3		
72	516839	174238	29.6	24.1	23.7	16.0	21.5	19.8	21.8	17.4	22.9	28.9	29.7	25.2	23.4	20.6		
73	513722	172873	31.4	30.6	28.1	22.2	25.6	22.3	23.4	22.4	26.2	26.8	36.2	24.6	26.6	23.4		
74	519856	175856	37.9	32.8	34.2	26.9	32.4	30.8	28.7	27.1	32.1	38.0	38.6	26.1	32.1	28.3		
75	515459	171029	32.0	26.0	26.3	18.5	24.8	25.0	24.7	23.5	26.0	30.6	31.4	25.3	26.2	23.0		
76	516588	171357	31.0	22.5	23.7	15.2	22.6	21.5	20.8	23.8	31.1	29.9	32.6	19.1	24.5	21.6		
77	514705	172092	31.9	30.2	30.8	20.0	25.4	23.4	23.5	25.7	26.0	28.7	30.8	24.1	26.7	23.5		
79	514810	172041	30.2	24.6	24.4	22.3	23.6	23.2	21.0	19.9	23.0	25.1	31.4	22.8	24.3	21.4		
80	520538	175926	30.7	23.2	24.6	16.5	20.7	20.9	19.6	18.6	22.5	28.6	29.1	22.5	23.1	20.3		
81	519912	175939	36.0	36.6	35.7	25.6	35.0	30.7	31.6	30.6	35.3	31.5	40.1	26.9	33.0	29.0		
82	516060	173708	25.6	22.1	22.1	11.2	17.7	16.4	17.0	18.4	21.4	26.3	26.3	20.0	20.4	17.9		
83	513811	169510	28.7	26.3	25.5	20.1	26.2	27.0	22.9	23.9	28.0	30.6	34.2	22.0	26.3	23.1		
84	513872	169518	21.9	16.1	16.0	11.9	14.2	13.1	12.8	13.0	15.5	19.4	22.6	15.2	16.0	14.0		
85	517911	174737	46.0	44.0	33.2	39.3	38.6	39.0	39.6	44.8	43.2	41.7	40.7	38.0	40.7	35.8		
87	518280	175367	33.9	39.2	40.5	28.8	39.9	40.4	41.0	31.3	42.3	43.0	49.3	30.4	38.3	33.7		
Rut 01	516415	173419	28.0	25.8	26.4	19.0	22.5	22.2	22.5	21.5	23.7	28.9	31.4	19.9	24.3	21.4		
Rut 02	517917	174928	45.6	44.0	41.3	39.0	41.6	37.9	40.5	38.4	46.0	41.7	43.3	31.7	**40.9**	36.0	30.9	
105	521315	175461	38.1	34.3	37.8	29.6	34.8	38.4	36.2	36.6	32.8	35.5	38.9	26.6	35.0	30.8		
211	514476	171310	34.7	26.1	23.6	22.8	28.8	28.5	25.5	24.6	31.0	31.5	33.9	27.0	28.2	24.8		
RP11	517456	169342	38.4	29.0	35.7	21.3	31.0	28.5	27.4	29.5	33.0	33.6	33.5	23.2	30.3	26.7		
RP12	515371	168705	31.4	31.9	36.0	28.2	33.4	29.0	29.4	33.1	30.5	39.9	32.4		32.3	28.4		

For triplicate sites see below.

Triplicate NO_2 diffusion tube results for sites 23 and 37 in µg m^{-3}

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sept	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted	Annual Mean: Distance Corrected to Nearest Exposure	Comment
23	522502	177166	22.1	19.0	20.3	15.0	16.8	13.4	13.7	12.3	17.6	19.9	25.1	17.0	17.7	15.6		
23/2	522502	177166	25.5	18.5	19.9	14.3	16.9	12.9	14.7	12.6	16.4	20.1	26.5	16.6	17.9	15.8		
23/3	522502	177166	25.9	17.2	19.4	13.6	16.6	13.3	13.5	12.9	15.0	20.4	22.7	17.4	17.3	15.2		
23 Mean	522502	177166	24.5	18.2	19.9	14.3	16.8	13.2	14.0	12.6	16.3	20.1	24.7	17.0	17.6	15.5		Triplicate mean
37	522993	176731	19.4	13.6	13.0	9.3	12.1	9.1	9.3	11.2	13.8	16.8	18.8	13.5	13.3	11.7		
37/2	522993	176731	20.1	12.9	15.6	9.1	11.8	9.5	10.2	10.7	12.7	15.1	21.7	13.0	13.5	11.9		
37/3	522993	176731	19.4	14.0	12.9	9.0	10.5	9.1	9.7	10.0	13.5	15.3	20.0	14.4	13.2	11.6		
37 Mean	522993	176731	19.6	13.5	13.8	9.2	11.4	9.2	9.7	10.6	13.4	15.7	20.2	13.6	13.3	11.7		Triplicate mean

☒ **All erroneous data has been removed from the NO_2 diffusion tube dataset presented in Table** U

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LLAQM.TG19.**

☐ **Local bias adjustment factor used.**

☒ **National bias adjustment factor used.**

☒ **Where applicable, data has been distance corrected for relevant exposure in the final column.**

☒ **London Borough of Richmond upon Thames confirm that all 2024 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

Notes:

Exceedances of the NO_2 annual mean objective of 40µg m^{-3} are shown in **bold** and highlighted in orange.

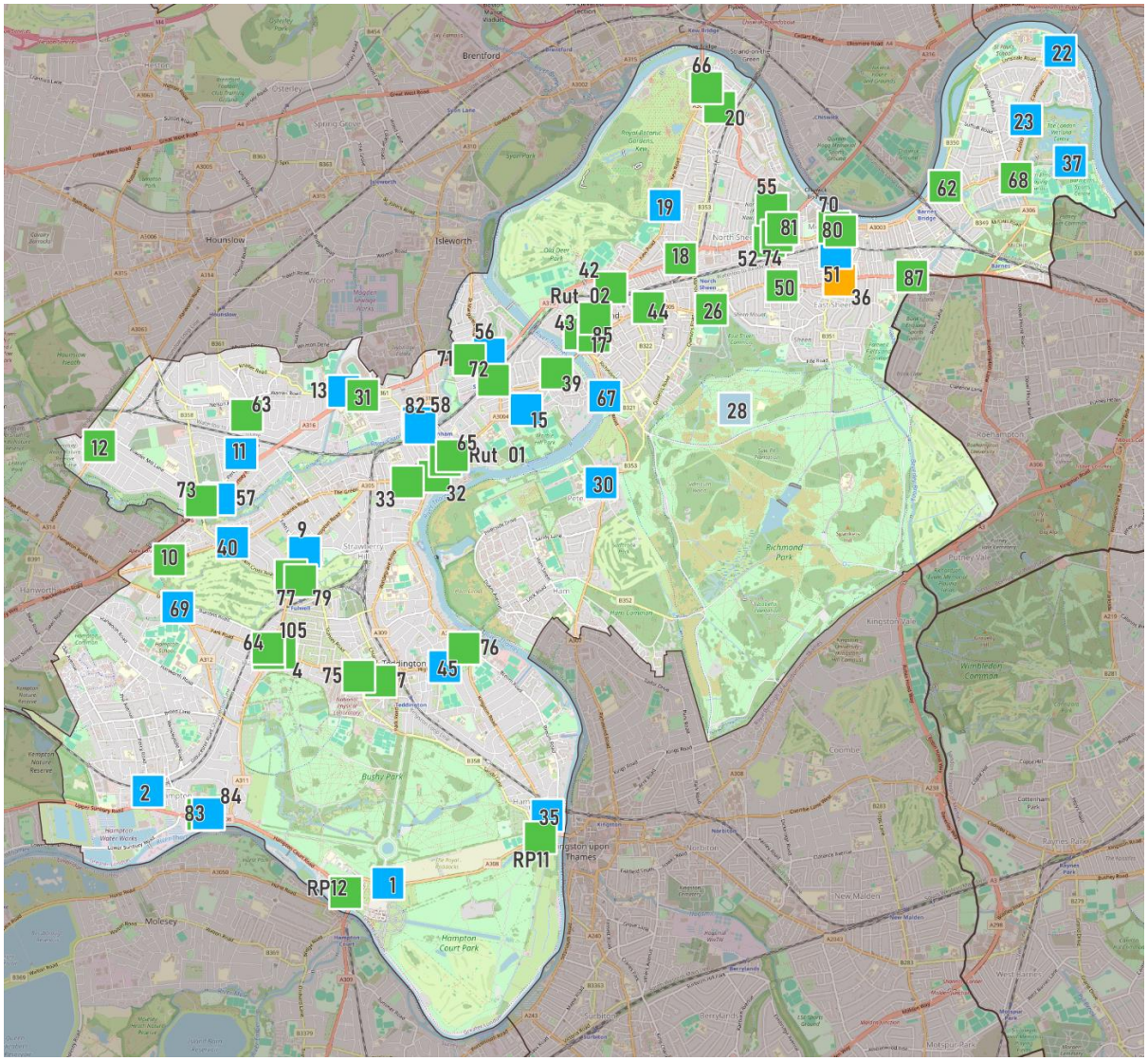
NO_2 annual means exceeding 60µg m^{-3}, indicating a potential exceedance of the NO_2 1-hour mean objective are shown in **bold and underlined**.

Sites that comply with the NO_2 annual mean objective of 40µg m^{-3} are shown in **green.**

See Appendix C for details on bias adjustment and annualisation.

Appendix C Map(s) of Monitoring Locations and AQMAs

Figure C. Map of Non-Automatic Monitoring Sites

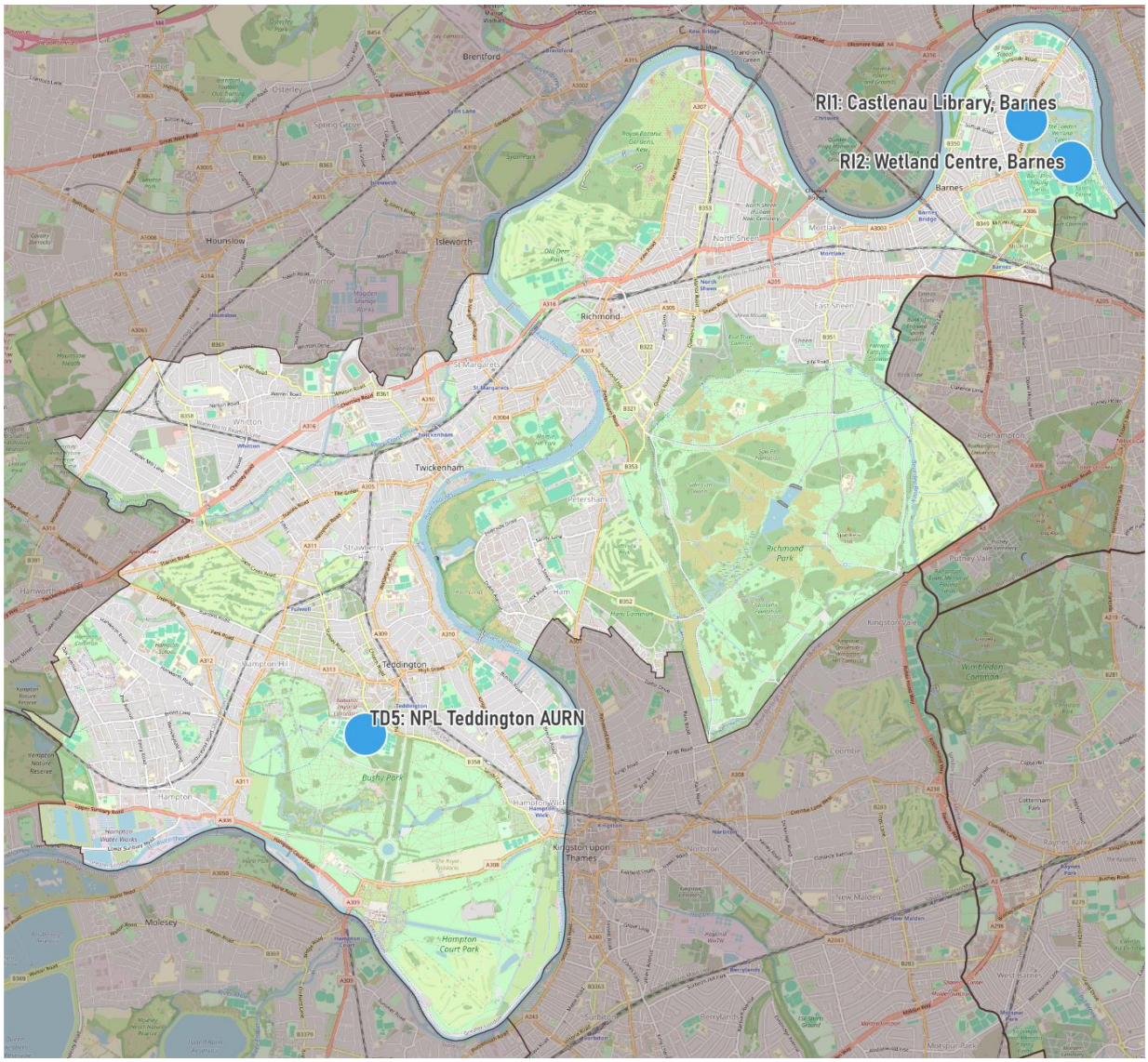


Annual average NO_2 concentration for 2024 (µg m^{-3})

	0-9	WHO objective compliant (10 µg m^{-3})
	10-19	Richmond target compliant (20 µg m^{-3})
	20-39	National air quality objective compliant (40 µg m^{-3})
	40+	Non-compliant

The whole borough is an AQMA.

Figure D. Map of Automatic Monitoring Sites



Appendix D Air Quality Monitoring Programme for state schools in LBRuT 2022 – 2024

Richmond Air Quality team committed to monitoring air quality at 12 monitoring sites per annum in Primary Schools in the Air Quality Action Plan 2020 - 2025.

Following various enquiries and requests from residents, parents and Councillors in 2021, the team decided to increase this target – both the duration and the number of schools. It will now provide 12 monitors (one monitor a month for 12 months) for each state primary school in the borough and include state nursery and senior schools.

From the beginning of January 2022, LBRuT commenced a 3-year programme to monitor 24/7 for a full year, as close as possible to the main school gate or worst-case scenario for each school. This will give robust data on air quality for all state schools within the borough.

In 2024, the Council monitored at 8 x Primary Schools and 4 x Senior Schools. This is in addition to the 7 x schools monitored as part of the permanent monitoring schedule or part of additional proposed road schemes. All results for the schools monitored in 2024 are below.

NO_2 falls off quickly with distance from source, largely road traffic in this borough, so levels within the school playground and within buildings set back from the road, sometimes with a barrier, will be lower, than those recorded outside on the pavement. Reductions in levels will vary, the difference can be slight or significant, depending on distance from major road and/or height and density of barrier. The results below indicate that levels within all 19 schools monitored in 2024 are within UK limit values for NO_2.

However, parents should be mindful of the route they walk to school as many pupils are exposed to higher levels of air pollution during the walk to/from school, many at peak hours, than those experienced at school during the student day. Levels inside vehicles may be higher still.

Please note NO_2 (nitrogen dioxide) has been monitored 24/7 by passive diffusion tube, an accepted and accredited means of monitoring NO_2 and used borough wide, comparable to results within this report. A similar device does not exist for PM (particulate matter). To get an idea of levels, officers used a hand held MET One Aerocet 831 for PM_{10} and $PM_{2.5}$ measurements. These measurements are spot check readings on the day.

AQ monitoring for LBRUTNursery/Primary and Senior Schools		NO_2 (ug/m3) 2024												Gradko 0.88	
Site ID	School	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual mean	Bias adjusted
Sch 36	St Mary's CE Prim Sch (middle) Strafford Road, TW1 3AD	19.10	16.51	14.43	11.46	11.59	10.60	9.71	8.01	15.12	16.68	23.87	15.87	**14.4**	**12.7**
Sch 37	Waldegrave School, Fifth Cross Rd, TW2 5LH	20.99	14.27	15.65	10.99	11.35	9.78	10.02	9.76	missing	16.42	22.88	14.23	**14.2**	**12.5**
Sch 38	Hampton High Schl, Hanworth Rd, Hamptn TW12 3HB	25.11	17.17	missing	12.88	13.84	13.12	11.70	12.03	17.24	20.99	23.30	14.04	**16.5**	**14.5**
Sch 39	Buckingham Prim Schl, Buckingham Rd, Hampton TW12	24.12	15.37	14.27	10.87	12.03	11.25	10.14	9.87	13.82	18.18	20.56	14.06	**14.5**	**12.8**
Sch 40	Hampton Inf Schl and Nursery, Ripley Rd, TW12	18.67	12.26	13.64	8.46	9.10	8.06	7.29	7.91	11.83	13.66	21.11	14.37	**12.2**	**10.7**
Sch 41	Hampton Jnr Schl, Percy Rd, Hampton TW12 2LA	24.41	16.04	17.72	12.37	12.49	10.50	10.02	9.56	15.94	20.55	25.53	15.36	**15.9**	**14.0**
Sch 42	St Mary's Hampton CofE Primary, Oldfield Rd, TW12 2HP	16.53	11.83	13.47	8.37	9.23	9.26	7.01	8.14	11.07	12.21	16.18	10.43	**11.1**	**9.8**
Sch 43	Twickenham Schl, Percy Rd, Twickenham TW2 6JW	25.54	21.03	22.12	16.66	17.97	17.17	13.77	13.67	20.45	19.86	31.19	18.97	**19.9**	**17.5**
Sch 44	Richmond-upon-Thames Schl, Egerton Road,TW2 7SJ	23.82	16.55	15.92	11.75	12.90	11.75	11.09	14.93	missing	18.60	26.81	17.83	**16.5**	**14.6**
Sch 45	Lowther Prim Schl, Stillingfleet Rd, Barnes SW13 9AE	24.44	17.44	17.60	9.72	11.40	13.34	11.00	9.79	14.18	17.21	24.72	14.10	**15.4**	**13.6**
Sch 46	Grey Court Schl, Ham St, Richmond TW10 7HN	22.16	15.42	14.59	6.14	13.79	11.38	9.54	9.65	13.67	13.68	missing	16.23	**13.3**	**11.7**
Sch 12	Nelson Primary Sch, Nelson Rd, TW2	26.63	19.39	20.37	13.28	15.38	13.60	13.42	14.93	19.74	22.44	23.33	17.46	**18.3**	**16.1**
105	East Sheen Prim Schl, URRW, SW14	38.11	34.27	37.83	29.61	34.78	38.40	36.21	36.63	32.85	35.54	38.88	26.59	**35.0**	**30.8**
71	St Stephens Prim Schl, Winchester Rd, TW1	36.80	35.48	35.28	29.04	missing	32.33	30.65	33.91	28.64	31.30	34.44	25.56	**32.1**	**28.3**
20	Queens RC Prim Schl, Cumberland Rd, TW9 3HJ	34.97	29.22	30.16	23.26	30.47	25.82	25.91	23.33	25.45	29.84	37.76	24.92	**28.4**	**25.0**
84	Christs School, Queens Rd, Richmond	21.86	16.08	16.00	11.89	14.17	13.14	12.80	12.98	15.47	19.35	22.63	15.17	**16.0**	**14.0**
51	Thomson Hse, Sheen Lane, SW14	25.47	21.70	20.74	16.01	19.15	17.69	16.73	16.13	21.36	24.94	31.27	18.11	**20.8**	**18.3**
30	The Russell School, Petersham Rd, TW10 7AH	26.26	19.54	19.89	12.34	19.10	15.86	15.31	14.80	18.53	22.61	25.65	17.69	**19.0**	**16.7**
215	Hampton Hill Jnr Schl, St James Ave, TW12	19.28	14.31	missing	9.93	9.85	9.44	8.73	9.02	13.30	15.20	20.17	15.90	**13.2**	**11.6**

UK annual limit value: NO2 = 40 ug/m3. WHO guidelines = 10ug/m3. All monitoring sites are as close as possible to the main school gates or worse case scenario for school exposure

Key:	
	0-20 µg/m³ (complies with UK annual NO2 limit value)
	20-40 µg/m³ (complies with UK annual NO2 limit value)
	40-60 µg/m³ (exceeds UK annual NO2 limit value)
	over 60 µg/m³ (exceeds UK annual NO2, likely exceeds UK hourly NO2 limit value)

2024 Air Quality hot spot PM10 monitoring for LBRuT Nursery, Primary & Senior Schools		PM10 (ug/m^3) 2024											
Site ID	School	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sch 36	St Mary's CE Prim Sch (middle) Strafford Road, TW1 3AD	15.1	18.8	16	12.8	13.3	8	4.8	6.5	7.9	13.8	13.5	9.4
Sch 37	Waldegrave School, Fifth Cross Rd, TW2 5LH	16.6	19.6	15	8.3	13.7	10.8	5	6.1	9.87	16.9	12.3	8.1
Sch 38	Hampton High Schl, Hanworth Rd, Hamptn TW12 3HB	14.1	19.5	10	9.4	17.9	9.6	6.2	6.3	6.7	14.8	12.1	7
Sch 39	Buckingham Prim Schl, Buckingham Rd, Hampton TW12	13.4	18.8	10	9	16.3	10.2	6.3	4.7	8.1	15.1	10.5	7.8
Sch 40	Hampton Inf Schl and Nursery, Ripley Rd, TW12	14.8	17.6	11	12.5	15.6	12.3	5.4	5.2	9.2	15.4	11.6	6.8
Sch 41	Hampton Jnr Schl, Percy Rd, Hampton TW12 2LA	13.6	17.3	12.5	10.6	14.6	11.1	4.8	5.7	11.8	15.1	11.2	10.7
Sch 42	St Mary's Hampton CofE Primary, Oldfield Rd, TW12 2HP	12.2	17.2	7	10.1	16.1	9.9	7.4	6.2	11.8	12.1	11.7	9.6
Sch 43	Twickenham Schl, Percy Rd, Twickenham TW2 6JW	11.2	17.2	11	12.5	13.2	9.5	11.6	4	14.3	15.1	10.1	12.6
Sch 44	Richmond-upon-Thames Schl, Egerton Road,TW2 7SJ	7.9	16.1	14	12.2	16.5	8.9	6.4	5.1	13.6	16.6	11.6	7.1
Sch 45	Lowther Prim Schl, Stillingfleet Rd, Barnes SW13 9AE	14.4	14.2	11.8	10.1	16.2	10.4	7.7	5.2	13.5	15.1	12.3	9.4
Sch 46	Grey Court Schl, Ham St, Richmond TW10 7HN	14.4	16.4	10	9	13.3	8.7	5.4	5.3	13.3	14.4	10.2	8.7
Sch 12	Nelson Primary Sch, Nelson Rd, TW2	11.1	16.2	12	9.2	13.2	8.2	7.1	3.6	12.1	7.8	10.8	12.2
105	East Sheen Prim Schl, URRW, SW14	15.8	20.4	14	11.2	16.6	11.6	9.6	6	13.6	17.6	13.6	14.2
71	St Stephens Prim Schl, Winchester Rd, TW1	13.6	20.6	13	10.6	15.8	11.3	8.4	5.9	11.9	16.3	13	14.0
20	Queens RC Prim Schl, Cumberland Rd, TW9 3HJ	14.2	20.6	14	11.8	16.8	11.7	9.3	6.2	13.8	17.2	13.4	14.1
84	Christs School, Queens Rd, Richmond	12.3	18.8	10	10.6	13.9	10.2	6.2	5.8	9.2	15.4	11.6	10.2
51	Thomson Hse, Sheen Lane, SW14	12.2	16.9	12.5	10.2	15.7	10	7.4	5.2	11.8	15.4	11.8	10.3
30	The Russell School, Petersham Rd, TW10 7AH	11.6	16.5	14	10.7	15.6	8.9	4.7	13.4	13.5	12.6	10.7	8.5
215	Hampton Hill Jnr Schl, St James Ave, TW12	13.2	16.8	14.5	5.2	18.5	10.6	5.2	5.3	12.2	11.5	11.9	7.4
Annual mean UK limit value PM10 = 40ug/m3; WHO guidelines =15ug/m3													

2024 Air Quality hot spot PM2.5 monitoring for LBRuT Nursery, Primary & Senior Schools		$PM_{2.5}$ (ug/m^3) 2024											
Site cod	School	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sch 36	St Mary's CE Prim Sch (middle) Strafford Road, TW1 3AD	9.1	10.4	7	5.7	12.1	4	1.9	3.4	4.8	6.4	8	4.3
Sch 37	Waldegrave School, Fifth Cross Rd, TW2 5LH	9.8	10.6	6.5	4.4	12.6	5	2	3.1	7.8	7.6	7.8	4.5
Sch 38	Hampton High Schl, Hanworth Rd, Hamptn TW12 3HB	5.9	10.5	5.5	5.4	12.7	4.8	2.2	2.8	5.3	5.7	8.4	2.9
Sch 39	Buckingham Prim Schl, Buckingham Rd, Hampton TW12	6.4	8.8	5.4	4.7	12	5.2	2.1	2.2	6	6.4	7.9	3.3
Sch 40	Hampton Inf Schl and Nursery, Ripley Rd, TW12	6.6	9.4	5.4	5.6	11.4	4.6	2.4	3	7.9	6	8.3	3.2
Sch 41	Hampton Jnr Schl, Percy Rd, Hampton TW12 2LA	6.5	9.8	5.5	5.7	11.5	5.6	1.9	2.7	9.1	6	6.5	3.9
Sch 42	St Mary's Hampton CofE Primary, Oldfield Rd, TW12 2HP	6.6	7.9	4	5.3	11.1	5.2	2.2	2.7	7.2	6.3	6.7	3.9
Sch 43	Twickenham Schl, Percy Rd, Twickenham TW2 6JW	6.1	9.7	4.5	5.8	11.7	4.7	4.3	2.5	9.3	4.6	6.6	3.8
Sch 44	Richmond-upon-Thames Schl, Egerton Road,TW2 7SJ	4.9	9.4	7	5.7	12.4	3.8	2.8	2.3	8	5.7	6.9	3.3
Sch 45	Lowther Prim Schl, Stillingfleet Rd, Barnes SW13 9AE	6.6	9.8	6.6	5.4	11.6	4.9	2.6	2.5	8.2	6	8.4	3.5
Sch 46	Grey Court Schl, Ham St, Richmond TW10 7HN	6.8	7.8	5	4.7	12.2	5.2	2.4	2.5	5.1	5.8	6.8	3.2
Sch 12	Nelson Primary Sch, Nelson Rd, TW2	6.4	7.9	6	4.7	11.6	4.4	2.4	2.8	7.4	3.7	7.5	3.3
105	East Sheen Prim Schl, URRW, SW14	13.6	12.2	7	5.8	12.2	5.5	3.5	3	8.8	8.6	8.8	3.8
71	St Stephens Prim Schl, Winchester Rd, TW1	11.8	12.1	6.5	5.7	12.1	5.3	4	2.8	8.4	8.2	8.5	3.9
20	Queens RC Prim Schl, Cumberland Rd, TW9 3HJ	13.8	12.1	7	5.7	12.5	5.6	4.1	3.1	9.1	7.9	8.6	3.9
84	Christs School, Queens Rd, Richmond	6.8	9.6	5.4	4.8	11.4	4.7	3.2	2.4	7.2	6.7	6.8	3.5
51	Thomson Hse, Sheen Lane, SW14	9.7	9.9	7.05	4.9	11.6	4.8	3.6	2.4	7.5	5.6	6.9	3.3
30	The Russell School, Petersham Rd, TW10 7AH	6.2	7.6	5.5	4.8	12.8	5.2	2	4.5	6.3	5.2	6.6	3.2
215	Hampton Hill Jnr Schl, St James Ave, TW12	8.6	6.9	5.5	3.1	14.8	4.6	2.3	2.8	6.6	4.6	7.9	3
Annual mean UK limit value: PM2.5 = 20ug/m3; London Mayoral objective = 10ug/m3; WHO guidelines = 5ug/m3													

Appendix E Technical note bias correction review for 2024 data – Dr I. Kilbane-Dawe[2]

Diffusion tube bias observed at four sites in 2023-2024

Summary This technical note analyses nitrogen dioxide (NO_2) bias between co-located diffusion tubes and automatic monitors at four sites. At three sites, no statistically significant trend was found. At the fourth site, Castelnau, a strong and statistically significant upward trend in bias was identified. This trend is unexpected for the 50% TEA-acetone tubes used and suggests possible experimental or environmental issues. Further investigation is recommended, and the use of national correction factors should be considered until the cause is resolved.

Introduction

Bias in diffusion tube measurements of NO_2 when compared with high accuracy automatic monitors are well documented, and technical approaches for correction between the biases is set out by Government. This approach typically requires that biases are determined by co-locating three diffusion tubes (a triplet) at the inlet of a highly accurate automatic monitor, and comparing them using an annual average of monthly average measurements. This work is important for local and national policy purposes, as correction for these biases can substantially alter the NO_2 values determined using diffusion tubes, significantly affecting local and national policy. Unexpected behaviours in these biases can be a cause for concern about the experimental setup. This is the subject of this technical note.

2 *Dr Kilbane-Dawe has 33 years' experience in air quality, environment policy, and sustainable transport. He led the DfT Office for Science, AEA's 125-strong air quality team, and founded ESA's AI for environment programme. He has delivered over £100M in projects, including the GCSA's VW emissions inquiry, the first AI-enabled environmental satellite, and airTEXT, the first public air pollution alert system. His background is in atmospheric physics and chemistry, with a PhD from Cambridge on atmospheric modelling and measurement.*

Causes of diffusion tube bias

The main sources of diffusion tube bias (see literature review section) are:

Differences in laboratory setup, being the primary source of bias;
Winds strong enough to cause turbulent flow in the tubes;
Ambient UV and temperature, most notable by season;

2

NO_2 concentrations.

Correcting for differences in laboratory setup is the main purpose of diffusion tube bias correction, rather than factors such as distance from the road.

Seasonal variability in NO_2 diffusion tube bias is well-documented. Bias tends to be more negative in warmer months due to increased photochemical degradation by UV, while colder months often show less negative or even positive bias. This seasonal pattern is attributed to temperature-dependent reactions and varying atmospheric conditions affecting NO_2 uptake and retention in the tubes.

Reviews of biases from multiple laboratories suggests that:

The acetone-50% TEA mix when prepared by Gradko, is the most stable versus seasonal variation, with an essentially flat profile, and modest changes in a 10-20% band (see figure 1).
Water TEA solutions have more seasonal dependence.

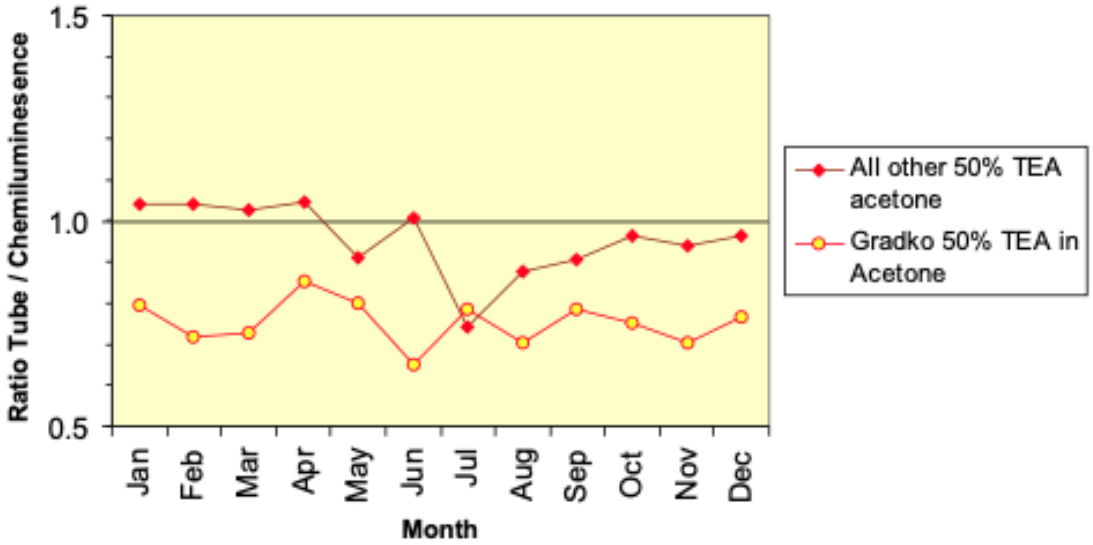


Figure 1. Seasonal variation observed in diffusion tube measurements using 50% TEA acetone doping, to a chemiluminescent detector. *Reproduced from "Compilation of Diffusion Tube Collocation Studies Carried out by Local Authorities," report for Defra by Duncan Laxen & Penny Wilson, 2002. Original caption: Ratio of tube to chemiluminescence vs time of year for tube prepares and analysed by other laboratories and by Gradko, using 50% TEA in acetone. Tubes exposed for one month intervals.*

Sustained changes in bias, for example a consistent increase or decrease over time, may indicate issues with the experimental setup (see literature review section). Potential causes include changes in laboratory analysis methods, alterations in tube preparation protocols, shifts in local environmental conditions or degradation of equipment. Such trends warrant a review to identify potential underlying issues.

Observed biases in 2023 and 2024

Monthly average biases compared with a co-located diffusion tube triplet or doublet using the 50% TEA-acetone technique were calculated for the following co-location sites, where diffusion tube monthly measurements were obtained following national technical guidance:

Castelnau automatic chemiluminescent monitor vs 3 diffusion tubes
Merton Civic Centre automatic chemiluminescent monitor vs 3 diffusion tubes
Barnes Wetlands automatic chemiluminescent monitor vs 3 diffusion tubes
Felsham Road automatic chemiluminescent monitor vs 2 diffusion tubes
Euston Road MCERTs automatic monitor vs 3 diffusion tubes.

The variation in monthly biases and secular trends in the same are shown in the figure below. This excludes Felsham Road station, which has insufficient automatic data to include in the analysis. The laboratory used for the Euston Road site was Socotec, the others were processed by Gradko.

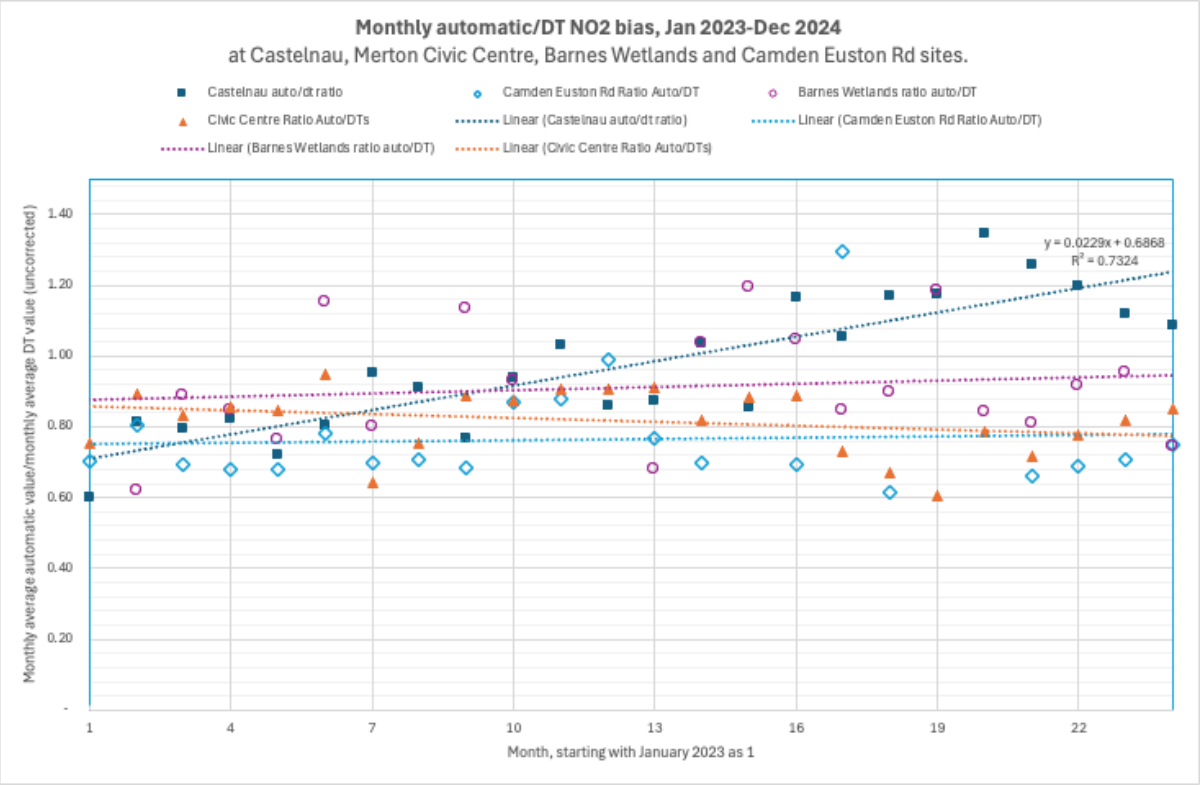


Figure 2. Observed bias between average monthly measurements of NO_2 using co-located automatic measurements and unadjusted diffusion tube data Jan 2023-Dec 2024. *Castelnau: blue solid squares; Merton Civic Centre: orange triangles; Barnes Wetlands: purple rings; Euston Road: blue diamonds. Estimated secular trends in the bias shown with dashed lines of the same colour.*

Visual inspection of the monthly data from January 2023 to December 2024 (circles and squares in the figure above) suggests no or very slight trend in the bias ratios at Euston Road, Merton Civic Centre and Barnes Wetlands, and a probable secular trends in the biases at Castelnau. This has significant policy implications as Castelnau is the local bias reference site, used for diffusion tube bias correction for all of LB Richmond upon Thames for many years. Problems at this site would therefore affect measurements across the whole borough.

A linear trend in the bias was calculated for each measurement site, using the least squares method. This is also plotted in the figure above as the dotted lines.

Statistical significance of the Castelnau trend

To investigate the likelihood that the Castelnau trend is real rather than a product of random variations in the bias (Figure 3, with raw data in the appendix), significance testing was conducted. From the 24 months of measurements, significance was tested using both a linear, least squares regression and a Bayesian linear model to statistically test the probability the observed trend results from random variability in the data.

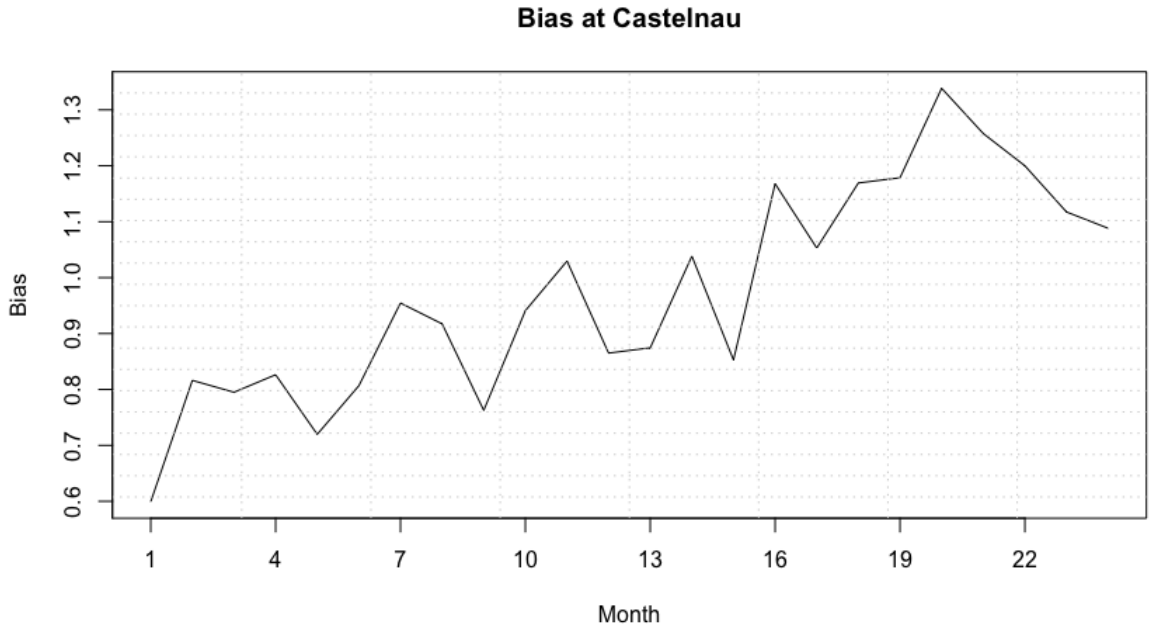


Figure 3. Bias between the automatic monitoring and diffusion tube triplet at Castelnau over the period January 2023 to December 2024.

For the linear regression, a t-test was conducted on the bias, giving a t-value of 7.73, and a likelihood that this is due to chance (p-value) around 1/10,000,000. This suggests is it exceptionally improbable that the trend is due to random data. This also estimated that around 73% of the observed changes in the bias were due to the secular trend.

Using a Bayesian approach, the probability of a trend being present is effectively 100%.

While these statistics do not explain the underlying cause of the trend, they confirm the visual suggestion that the trend is real. Since such a trend is not expected in an experimentally sounds setup, this offers a good reason to investigate the site to determine possible causes for this trend.

Conclusions

Diffusion tube biases are primarily intended to correct for inconsistencies between laboratories, with a lesser effect of correcting for local conditions. For 50%TEA-acetone mixtures, a seasonal variation in bias is not usually expected. A consistent trend in biases between a co-located diffusion tube triplet and an automatic monitor is considered a cause for investigation of the experimental setup. At the Castelnau site a statistically significant positive trend was found in the bias, which would not be expected from a normally operating co-location site.

Recommendations

Sustained changes in bias have the potential to be indicative of problems with the experimental setup, either of the diffusion tubes or the automatic monitors. Biases identified in data for two years at Castelnau were found to be highly likely to be caused by some uncontrolled factor causing a steady shift over time between the measurements made using the automatic monitor and the diffusion tubes, thus creating a trend in the biases. Further work should be conducted to investigate the source of these changes, and consideration given as to whether diffusion tube statistics for 2023 and 2024 should be corrected based on national correction factors pending resolution of these investigations. Given the policy implications of the use of biases at this site for correction of both diffusion tube data in LB Richmond upon Thames and in the national bias estimation, it is recommended that the average bias at this site not be used until the underlying causes of the secular trend are determined.

Acknowledgements

Thanks to Tom Parkes and LB Camden for sharing raw data at Euston Rd, and David Butterfield at National Physical Laboratory for useful feedback on initial calculations.

Linear analysis of the data was conducted in the R language using the LM model developed by the R Core Team (2024), described in *R: A Language and Environment for Statistical Computing*. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Bayesian analysis of the data was conducted in the R language using the brms package developed by Bürkner, P.-C. (2017). *brms: An R Package for Bayesian Multilevel Models Using Stan*. *J. Stat. Softw.*, 80(1), 1–28. https://doi.org/10.18637/jss.v080.i01

Appendix: Literature reviewed and notable points

(1) Compilation of Diffusion Tube Collocation Studies Carried out by Local Authorities, Duncan Laxen & Penny Wilson (2002)

Original studies by Tony Bush, Steven Moorcroft, Smith S, Stevenson K (2001) Validation of NO_2 Diffusion Tube Methodology in the UK, Atmos. Environ., 35, 289-296.
See also Review & Assessment: Pollutant Specific Guidance, LAQM.TG4(00), DETR (2000)
Gradko and 50% TEA in acetone the least seasonal variability in bias, so this suggests that for this setup we should not expect a bias drift over time.
No evidence of any pattern of differences in bias between roadside and other sites.
In 8 out of the 9 data sets there is a more negative bias at higher concentrations so there may be a relationship between tube performance and concentration. The exception is for Gradko 50% TEA in water tubes whose pattern is quite variable and no firm conclusions are possible.

(2) The Relationship Between Diffusion Tube Bias and Distance From the Road, Duncan Laxen & Ben Marner, AQC, 2006

PDT bias adjustment is primarily for laboratory techniques.
Roadside distance correction isn't required although it exists.
Corrections for chemistry in the tube can be done but this is pointless at or below 40µg/m3.

(3) Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users, Defra (2008)

Diffusion tubes are categorised as an "indicative" monitoring technique. This refers to a technique with relatively high uncertainty, in the case of diffusion tubes quoted as ± 25%. By contrast, the chemiluminescence method, used in most automatic ambient monitoring apparatus for NO_2, is defined as the reference method for this pollutant. There is a CEN standard for the chemiluminescent method14 (EN 14211:2005 "Ambient air quality - Standard method for the measurement of the concentration of NO_2 and nitrogen monoxide by chemiluminescence") and its uncertainty is typically quoted as ± 15%.
For diffusion tubes the determination of the absorbed NO_2 to for nitrite is temperature dependent, proportion with a power law of T^1.81. Accounting for different months temperatures was not recommended in 2008, as these were only being used for indicative monitoring (my emphasis).
The standing recommendation is to assume an average UK T of 11 C (giving 1.07412). If T was 25 C this would be 1.17186, a 9% difference.
Reject any DTs where there have been bonfires etc. near the site, or unusual traffic activity. Also those found on the ground or with dirt, insects or spiders inside.

(4) Investigation of the Effects of Harmonising Diffusion Tube Methodology, 2011

Performance of labs in preparing and analysing diffusion tubes varies wildly.

(5) Biases in the Measurement of Ambient NO_2 (NO2) by Palmes Passive Diffusion Tube: A Review of Current Understanding, Mathew R. Heal, Duncan P. H. Laxen, Ben B. Marner, Atmosphere 10(7), 357 (2019);

Strong evidence that measurement of NO_2 by PDT can be subject to bias from a number of sources. The most significant positive biases in normal usage are ambient wind flow at the entrance of the tube potentially leading to bias of tens of percent, and within-tube chemical reaction between NO and O3 causing bias up to ~25% at urban background locations (but much less at roadside and rural locations). Sources of potentially significant negative bias are associated with deployments in atmospheres with relative humidities <~75% that cause incomplete conversion of NO_2 to NO_2, and with long deployment times (i.e., several weeks) in warm and sunny conditions. There

is also evidence to suggest that biases (positive or negative) can be introduced by individual laboratories in the PDT preparation and NO_2 quantification steps.

More than one bias may be present in any given PDT deployment. The biases act independently so the net effect on PDT NO_2 determination is the linear summation of individual biases acting in a particular deployment. For some PDT deployments, positive and negative biases may offset each other leading to smaller net bias.

Studies examining experimental evidence for potential biases arising in PDT preparation have usually involved a spread of laboratories preparing and analysing the PDTs, and have concluded that PDT performance varied more with the laboratory than with any particular preparation variable.

The individual and net magnitude of bias that may impact NO_2 determination in an individual PDT deployment cannot easily be predicted or quantified. In theory, laboratory-derived biases can be minimised by adherence to good QA/QC procedures and participation in inter-analyst comparisons. Positive bias from wind effects can be substantially reduced either by use of a coarse mesh across the tube and/or with the tubes placed within a shelter. Membranes across the mouth of the tube should not be used since these may overcompensate for wind-induced positive bias by providing resistance to free molecular diffusion. The positive bias from within-tube chemical reaction between NO and O3 can, in principle, be eliminated by use of tube material that fully transmits the UV wavelengths relevant to NO_2 photolysis, but in practice this is hard to achieve and is likely incompatible with placing the tubes within a wind shelter. There is also an unresolved question concerning the accuracy of the value of the diffusion coefficient for NO_2 in air that is used to covert the mass of absorbed NO_2^- to average ambient NO_2 concentration. Any inaccuracy in D would proportionally apply universally to all NO_2 passive sampler measurements.

The effect of net bias can be reduced by application of a local “bias adjustment” factor derived from co-locations of PDTs with chemiluminescence analyser. When this is carried out, the PDT is suitable as an indicative measure of NO_2 for air quality assessments. However, it must be recognised that individual PDT exposures may be subject to unknown variation in the true bias adjustment factor for that exposure.

(6) Methodology review of the NO_2 Compliance Assessment: Evidence for using high quality measurements over PCM modelled concentrations (2020)

PCM performs less well than diffusion tubes, hence switch to PDTs.

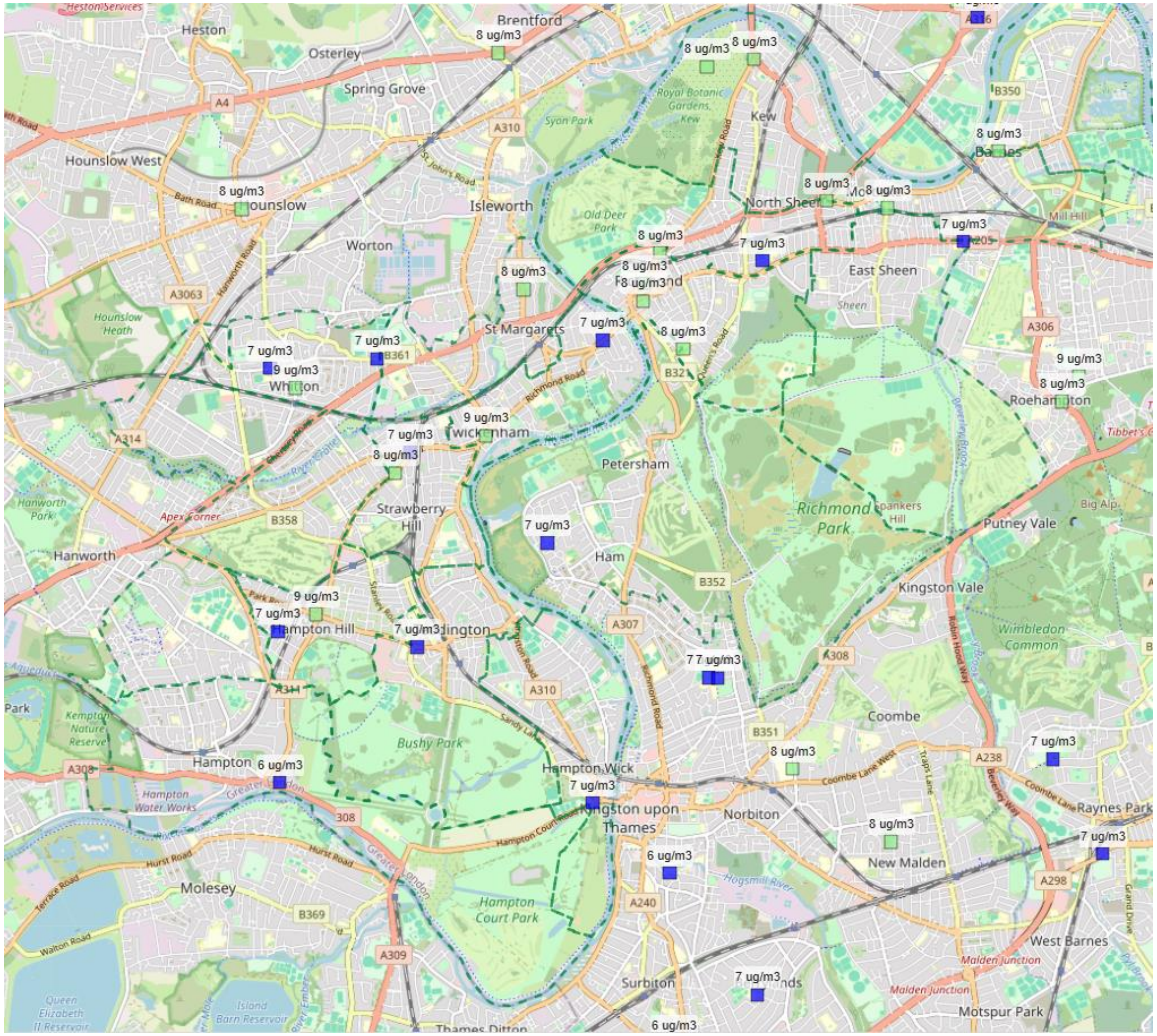
(7) Environment Agency/Joint Air Quality Unit UK Urban NO_2 Network Operational Annual Report 2021 (2022)

There are 34 sites with collocated PDTs and automatic AURN monitors, but the monthly bias data are not available.

Appendix: Automatic measurements using a chemiluminescent monitor and unadjusted diffusion tube triplet data at Castelnau, months 1-24 of 2023-2024.

Month	Average of Castelnau Diffusion Tubes 23/1,2,3	Castelnau automatic	Month	Average of Castelnau Diffusion Tubes 23/1,2,3	Castelnau automatic
1	28.7	17.2	13	24.7	21.6
2	28.3	23.1	14	18.3	19.0
3	20.0	15.9	15	19.7	16.8
4	19.0	15.7	16	14.3	16.7
5	15.7	11.3	17	17.0	17.9
6	15.0	12.1	18	13.0	15.2
7	11.0	10.5	19	14.0	16.5
8	13.3	12.2	20	12.7	17.0
9	17.7	13.5	21	16.3	20.5
10	20.3	19.1	22	20.0	24.0
11	23.7	24.4	23	24.7	27.6
12	16.3	14.1	24	17.0	18.5

Appendix F PM2.5 Monitoring by Breathe London Nodes in 2024



Legend

Annual average PM2.5 (µg m^{-3})

- 5-7.5
- 7.5-10 under GLA interim target 1

Breathe London nodes were operational in LBRuT in 2024 up until 1st October 2024. In October 2024 the Breathe London contract expired, so Richmond Council arranged a temporary contract directly with the sensor provider, Clarity, operational from 1st November 2024. Annual average PM2.5 measured by Breathe London nodes since 2021 can be viewed here:

https://swlonrsp.github.io/LBRUT_Map_PM25_2021_2024_BL.html