Air Quality Monitoring Networks in Hammersmith & Fulham

There are currently three types of air quality monitoring networks across the borough of Hammersmith & Fulham. The data from H & F Air Quality Monitoring Networks (1) and (3) below are included in the council's Annual Air Quality Status Report that are submitted to GLA and DEFRA (See https://www.lbhf.gov.uk/environment/pollution-and-air-quality/air-quality#reports)

1. Air Quality Monitoring Stations (AQMS)

In 2022 there were two continuous automatic Air Quality Monitoring Stations (AQMS) in the borough of Hammersmith & Fulham that provide real-time 24 hours a day air quality monitoring data. They are Shepherds Bush Green (HF4) and Hammersmith Town Centre (HF5) that are both roadside Air Quality Monitoring Sites. Further information can be found on the Air Quality England website

As part of the Clean Air Neighbourhood programme four new Air Quality Monitoring Stations have been installed in 2023 at roadside and urban background sites across the borough (See map overleaf). They are

- Fulham Town Centre (HF6) - Roadside
- Riverwalk (Frank Banfield Park) (HF7) - Urban Background
- Wormwood Scrubs (Du Cane Road) (HF8) - Roadside
- Sands End (Philpot Square) (HF9) - Roadside

Figure 1: Wormwood Scrubs Air Quality Monitoring Station (HF8)

Air Quality Monitoring Stations in Hammersmith & Fulham

LEGEND

Air Quality Monitoring Station Site

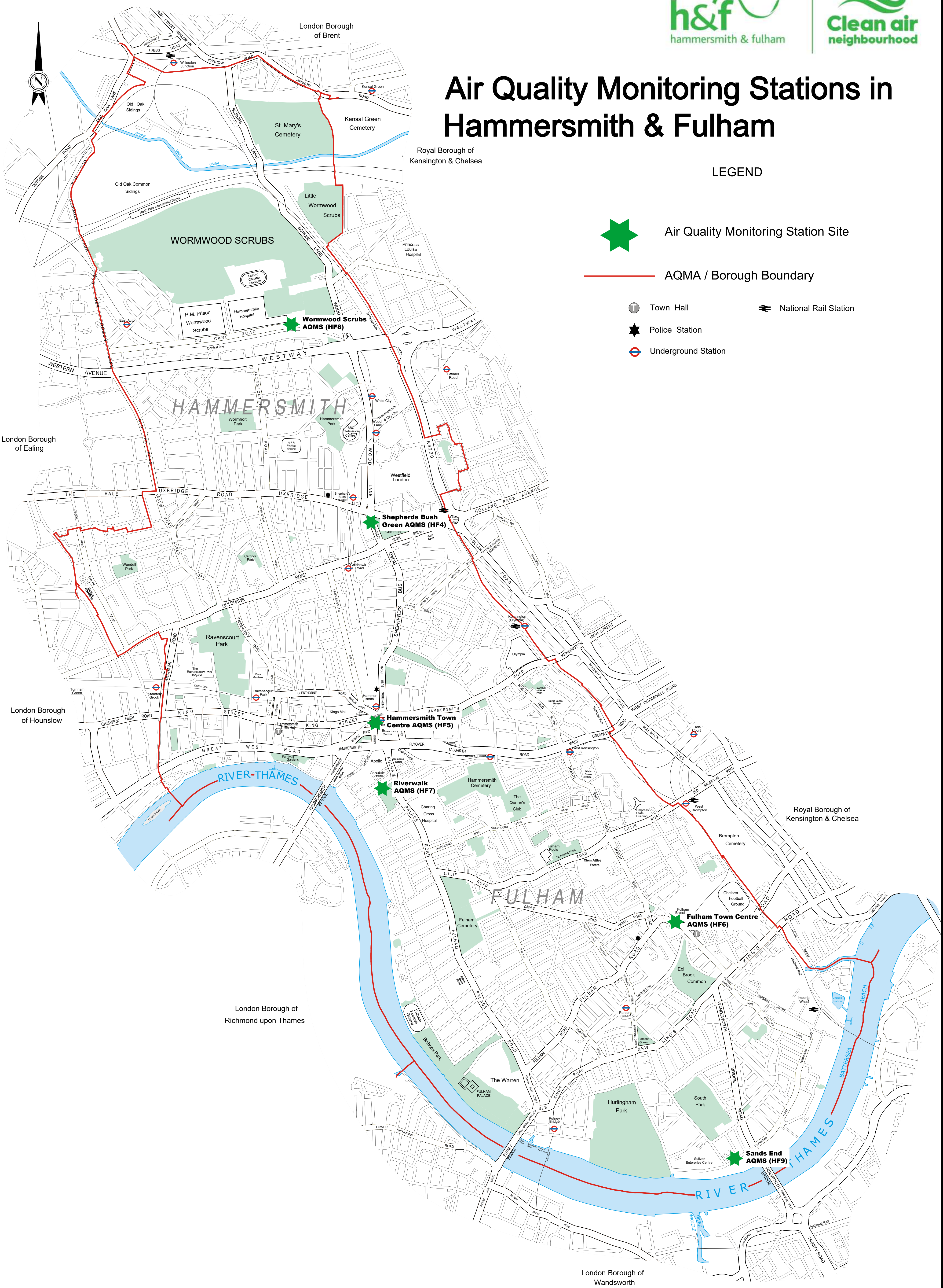
AQMA / Borough Boundary

Town Hall

National Rail Station

Police Station

Underground Station



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November 2022

Roadside Sites (within 1 – 5m of a busy Road) give a better idea of public exposure. Roadside sites are useful for identifying potential health hazards from traffic hotspots - especially those frequented by large numbers of pedestrians.

Background sites (more than 10m away from a main road) should not be dominated by one single nearby pollution source. They are located more than 10m away from a main road and 5 m away from anywhere vehicles stop with their engines idling. Quiet roads within residential areas, schools and other public buildings can be used as background sites if open space such as parks are not available.

The AQMS contains reference compliant equipment that continuously monitors and measures the Air Pollutants Nitrogen Dioxide (NO_2), Particulates ($PM_{2.5}$, PM_{10}) and Ozone (O_3) in a typical roadside cabinet (See below). The term 'reference' is applied to instruments which have demonstrated compliance with Defra's minimum performance requirements and data quality objectives.

For gaseous analysers and particulate analysers, reference instruments must achieve a measurement uncertainty of ± 10% at the relevant limit value.

2. Air Quality Sensor Networks

For the last few decades, most air quality monitoring around the world has been undertaken by central or local governments using reference-grade instruments. These reference networks have served as the foundation stone for research, policy development, health impact analysis and continue to play a vital role in our understanding of air quality.

Though this new generation of small automatic Air Quality sensors are improving and provide 24 hour data collection none of them have yet achieved 'reference equivalent' status. Instead, these sensors are assessed against a standard known as 'indicative'.

These indicative Air Quality Sensors have to meet the minimum EU Air Quality Directive for indicative (Class 1) methods for the monitoring of nitrogen dioxide (NO2) and particulate matter ($PM_{2.5}$) which is:

Nitrogen Dioxide (NO_2) **± 25%**
Particulates (PM2.5) **± 50%**

There are two indicative Air Quality Sensors networks named as Breathe London and Vortex located in the borough.

Breathe London Air Quality Sensors

The Breathe London network is run by the Environmental Research Group at Imperial College London - the same group who run the London Air Quality Network. All Breathe London Air Quality Sensors are co-located with London Air reference air quality monitors before being deployed.

A total of 57 breathe London Air Quality sensors have been installed across the borough during 2021-2023. These Air Quality Sensors are powered by solar panels and have been installed on lampposts at a height of between 2.5 - 3 metres.

As part of the Clean Air Neighbourhood Programme 47 of these Air Quality Sensors have been installed near the student entrances of Primary, Nursery and Secondary Schools across Hammersmith & Fulham. These locations were selected to monitor the impact of the Clean Air Neighbourhood Programme on the concentrations of the health impacting air pollutants NO_2 and $PM_{2.5}$ near to Schools. (See Table 1 and map below)

Breathe London Air Quality Sensor installed at Langford Primary School

There are also Breathe London Air Quality sensors installed near Charing Cross Hospital and Old Oak, White City and Edward Woods Community Centres as part of the Breathe London Community Programme.

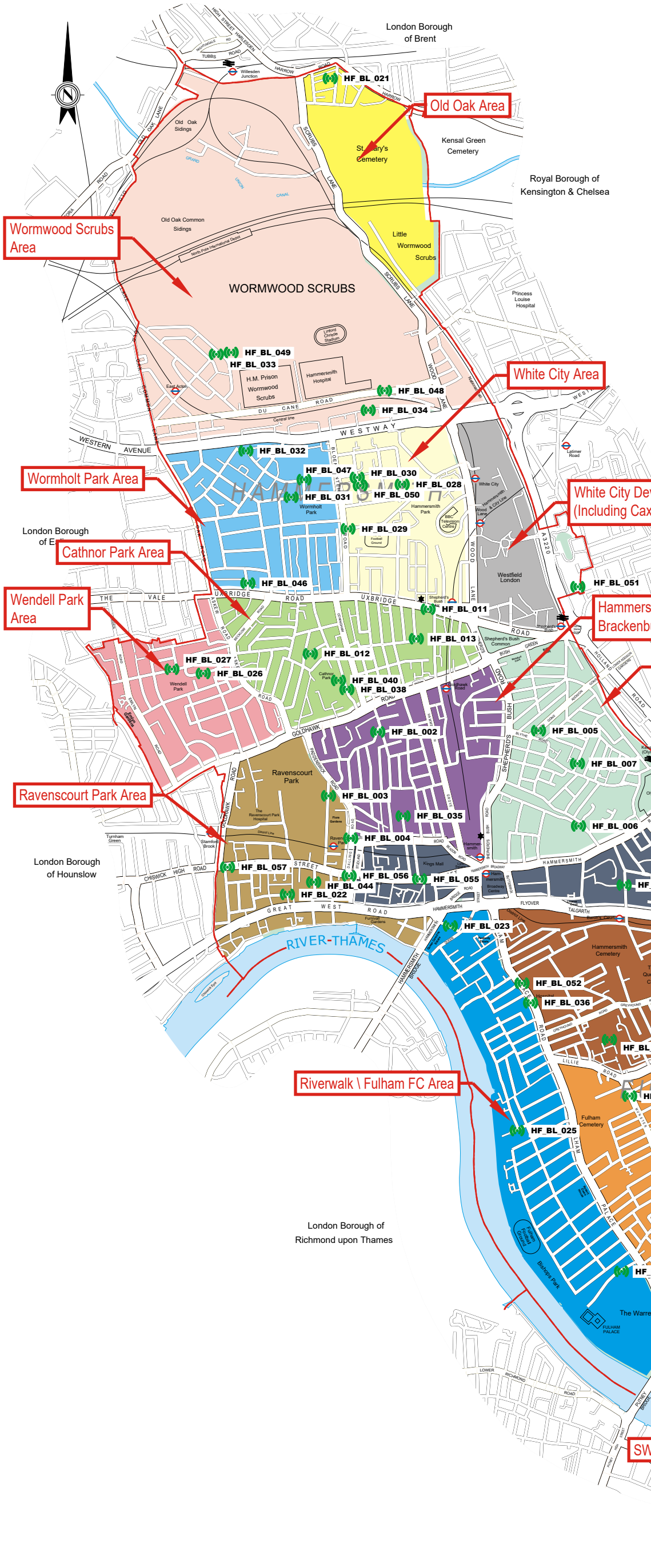
The most recent network accuracy report for the Breathe London Air Quality Sensors during the period October-December 2022 indicated the data uncertainty of 18% for NO_2 and 21% data uncertainty for $PM_{2.5}$.

The data from these Breathe London Air Quality Sensors is freely available to the public on the Breathe London website.

Air Quality Sensor Sites in Hammersmith & Fulham

hammersmith & fulham

Clean air neighbourhood



LEGEND

Breathe London Air Quality Sensor Sites
Clean Air Neighbourhood

AQMA / Borough Boundary

Town Hall

National Rail Station

Police Station

Underground Station

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January 2023

hammersmith & fulham

Table 1: Location of Breathe London Air Quality Sensors in Hammersmith & Fulham

Site ID	*Location*	*Installation Date*
HF_BL-AQS_001	St Augustine's Catholic Primary School	2022
HF_BL-AQS_002	Brackenbury Primary School	2022
HF_BL-AQS_003	John Betts Primary School	2022
HF_BL-AQS_004	Flora Gardens Primary School	2022
HF_BL-AQS_005	Addison Primary School	2022
HF_BL-AQS_006	Larmenier and Sacred Heart Catholic Primary School	2022
HF_BL-AQS_007	St Mary's Catholic Primary School	2022
HF_BL-AQS_008	Langford Primary School	2022
HF_BL-AQS_009	Thomas's Academy	2022
HF_BL-AQS_010	Sulivan Primary School	2022
HF_BL-AQS_011	St Stephen's Primary School	2022
HF_BL-AQS_012	Greenside Primary School	2022
HF_BL-AQS_013	Miles Coverdale Primary School	2022
HF_BL-AQS_014	Avonmore Primary School	2022
HF_BL-AQS_015	Sir John Lillie Primary School	2022
HF_BL-AQS_016	Normand Croft Community School	2023
HF_BL-AQS_017	St John's Walham Green C of E Primary School	2022
HF_BL-AQS_018	Holy Cross RC School	2022
HF_BL-AQS_019	St Thomas of Canterbury Catholic Primary School	2022
HF_BL-AQS_020	Fulham Primary School	2022
HF_BL-AQS_021	Kenmont Primary School	2022
HF_BL-AQS_022	St Peter's Primary School	2022
HF_BL-AQS_023	St Pauls Cofe Primary School	2022
HF_BL-AQS_024	All Saints C of E Primary School	2022
HF_BL-AQS_025	Queen's Manor School	2022
HF_BL-AQS_026	Good Shepherd RC Primary School	2022
HF_BL-AQS_027	Wendell Park Primary School	2022
HF_BL-AQS_028	Ark Swift Primary Academy	2022
HF_BL-AQS_029	Jack Tizard School	2022
HF_BL-AQS_030	St John XXIII Catholic Primary School	2022
HF_BL-AQS_031	Wormholt Park Primary School	2022
HF_BL-AQS_032	Ark Conway	2022
HF_BL-AQS_033	Old Oak Primary School	2022
HF_BL-AQS_034	Ark Bentworth Primary Academy	2022
HF_BL-AQS_035	Earls Court Primary School	2022
HF_BL-AQS_036	Melcombe Primary School	2021
HF_BL-AQS_037	Bayonne Nursery School & Children's Centre	2023
HF_BL-AQS_038	Vanessa Nursery School	2023
HF_BL-AQS_039	James Lee Nursery School	2023

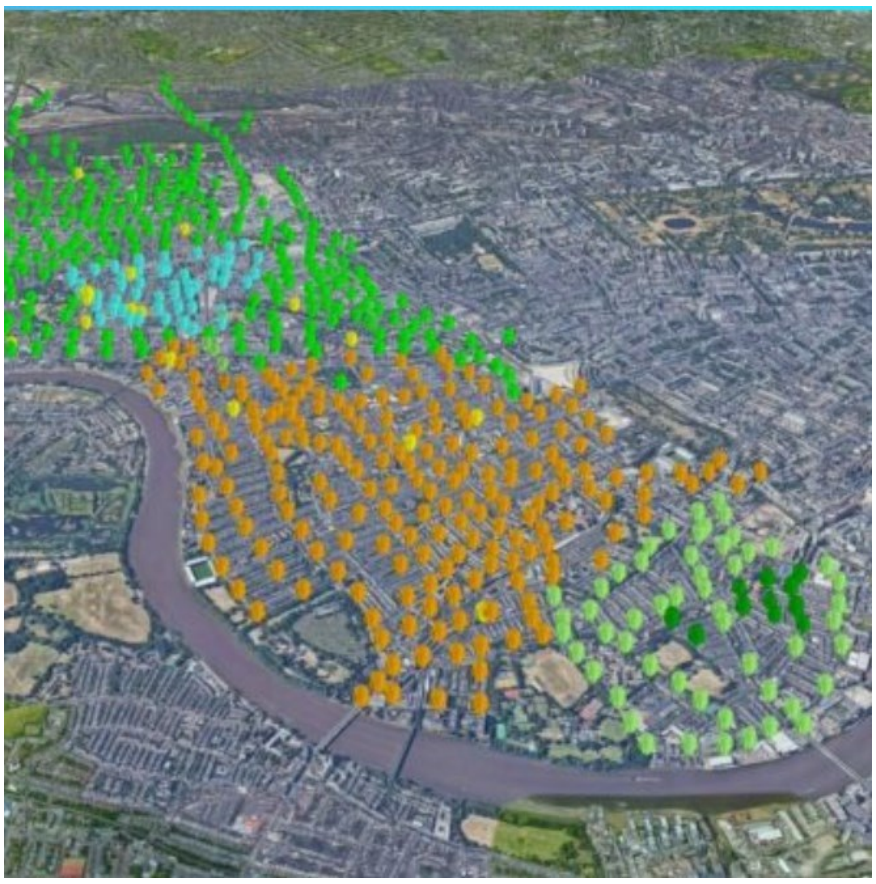
Site ID	Location	Installation Date
HF_BL-AQS_040	Hammersmith Academy	2023
HF_BL-AQS_041	Fulham Cross Girls School	2023
HF_BL-AQS_042	The Fulham Boys School	2023
HF_BL-AQS_043	Lady Margaret School	2023
HF_BL-AQS_044	West London Free School	2023
HF_BL-AQS_045	Hurlingham Academy	2023
HF_BL-AQS_046	Queensmill School	2023
HF_BL-AQS_047	Phoenix Academy	2023
HF_BL-AQS_048	Woodlane High School	2023
HF_BL-AQS_049	Old Oak Community Centre	2022
HF_BL-AQS_050	White City Community Centre	2022
HF_BL-AQS_051	Edward Woods Community Centre	2022
HF_BL-AQS_052	Charing Cross Hospital	2021
HF_BL-AQS_053	North End Road (North)	2021
HF_BL-AQS_054	North End Road (South)	2021
HF_BL-AQS_055	Safer Cycle Pathway, King Street _ A	2023
HF_BL-AQS_056	Safer Cycle Pathway, King Street _ B	2023
HF_BL-AQS_057	Safer Cycle Pathway, King Street _ C	2023

Vortex Air Quality Sensors

The Vortex Air Quality Sensors have been installed in approximately 100 locations on lampposts in Fulham, SW6 and the Brackenbury Village areas of the borough. As part of the Clean Air Neighbourhood Programme, it is proposed to install up to 500 Vortex Air Quality sensors has a boroughwide hyperlocal mesh network. (See Figure 2)

A Vortex Air Quality Sensor has been co-located with AQMS HF4 and AQMS HF5. They will also be collocated with each of the councils new four reference Air Quality Monitoring Stations (HF6, HF7, HF8, HF9) to improve the network accuracy of the NO_2, PM_{10} and $PM_{2.5}$ data from these indicative Vortex Air Quality Sensors.

Figure 2: Locations of existing Vortex AQ sensors in Fulham and Brackenbury and borough wide proposed locations

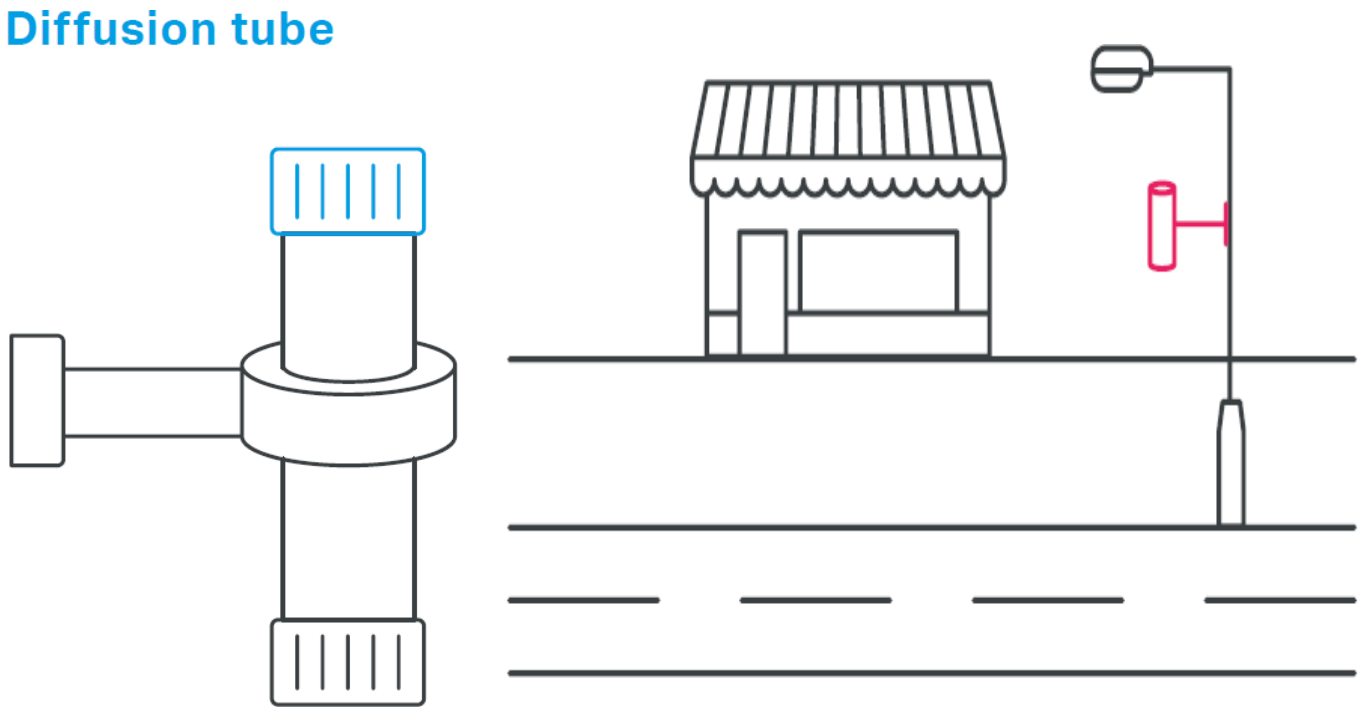


Vortex Air Sensor attached to a lamppost in Hammersmith & Fulham

3. Nitrogen Dioxide (NO_2) Diffusion Tube Network

There are currently non-automatic NO_2 Diffusion Monitors installed at 56 locations across the borough (See Map overleaf).

A diffusion tube is essentially a small plastic test tube that contain a material that reacts with NO_2 in the air. Diffusion tubes is used by the council to complement automatic monitoring data. They are a cheap and effective tool for measuring nitrogen dioxide (NO_2). Each tube costs less than £10 including analysis afterwards. Diffusion tubes are prepared by a laboratory, used in the measurement study and then returned for analysis. The NO_2 diffusion Tube Monitors are usually installed on lampposts in H&F at a typical breathing height of between 2.0-3.0 m.



The tubes are clear plastic with rubber stoppers at each end. They contain a steel mesh coated with a chemical which absorbs NO_2. When the tube is opened (by removing one of the rubber stoppers) the coated steel mesh is exposed to the air and absorbs NO_2.

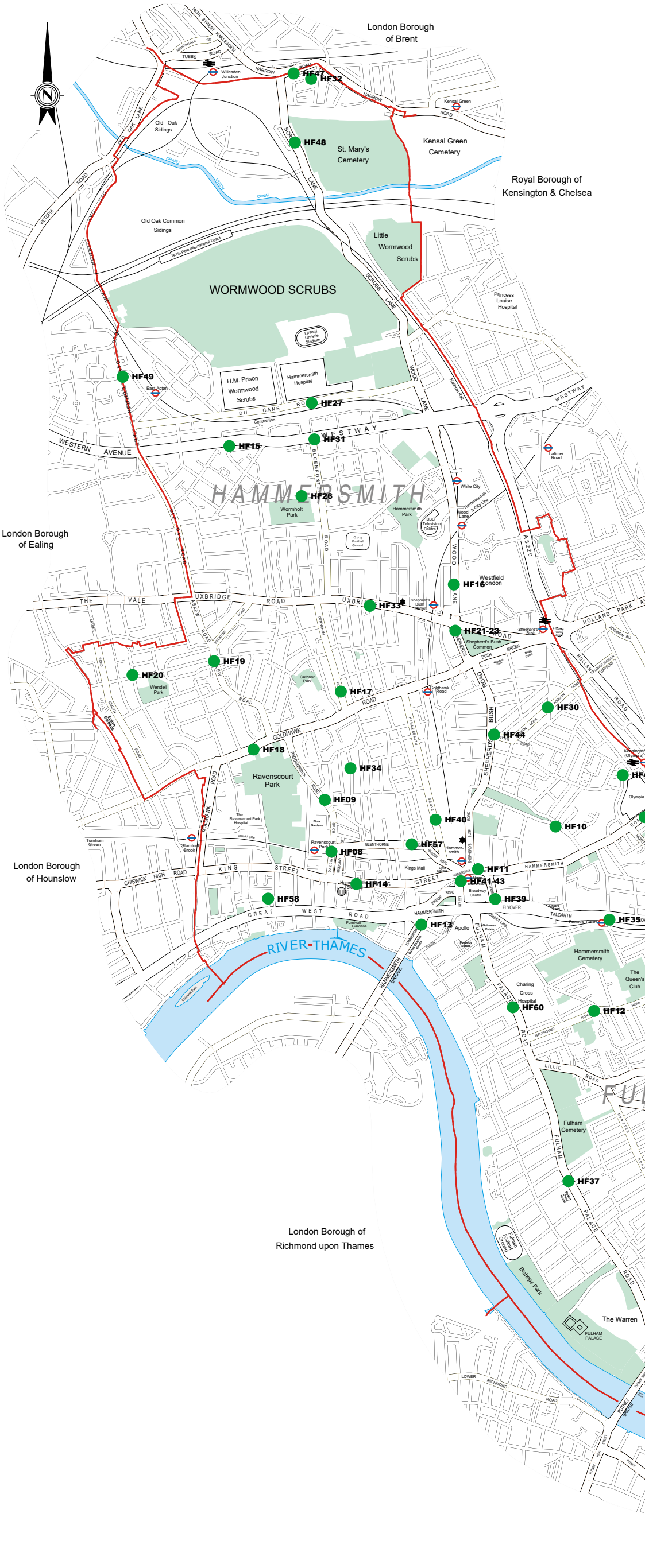
As NO_2 concentrations vary by season it is recommended diffusion tube monitoring programmes span a full year (that is twelve 4–5-week exposures).

The lab technicians measure how much NO2 has been absorbed by the mesh. Knowing the length of exposure and the total NO_2 absorbed they can calculate an average NO2 concentration for the exposure period. The measurements are expressed in micrograms per cubic metre (μgm^{-3}). This is a time specific average and as the monitoring is undertaken over a year the annual average concentration is calculated from the 12 x monthly measurements.

Diffusion tubes are also considerably less reliable (± 25%) and do not have the same time resolution as the automatic NO_2 reference monitors (± 10%).

The main limitation of diffusion tubes is they can report large over or underestimates. This is known as bias. It is very important that the bias in any diffusion tube study is identified, and the measurements adjusted accordingly before results are reported.

Nitrogen Dioxide (NO_2) Diffusion Tube Monitoring in Hammersmith & Fulham



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NO_2 Diffusion Tube monitor- Non-Automatic

AQMA / Borough Boundary

Town Hall

Police Station

Underground Station

National Rail Station

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November 2021