City of BRADFORD METROPOLITAN DISTRICT COUNCIL

2019 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management

December, 2019

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Executive Summary: Air Quality in Our Area

Air Quality in Bradford

Air pollution is associated with a number of adverse health impacts. It is recognised as a contributing factor in the onset of heart disease and cancer. Additionally, air pollution particularly affects the most vulnerable in society: children and older people, and those with heart and lung conditions. There is also often a strong correlation with equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3].

Actions to Improve Air Quality

The air pollutants of concern in Bradford are nitrogen dioxide NO_2 and particulate matter (PM). A significant source of these pollutants is traffic but industry, heat and power generation, domestic sources and natural activities also contribute.

Bradford has areas of high levels of deprivation and significant levels of health inequality. 27% of the Bradford district population live in areas classed as the 10% most deprived in England[4]. There are above average numbers of deaths from smoking, cancer, heart disease and strokes and it is estimated that emissions of man-made fine particles, $PM_{2.5}$ cause 4.3% of total mortality[5]. Improving public health outcomes and reducing deprivation are significant challenges for City of Bradford MDC.

Poor air quality is closely linked to poor health and is frequently identified in the most deprived wards of the city. City of Bradford MDC fully recognises that improving local air quality is essential to deliver better health outcomes for all. This is particularly important for the above national average numbers of young people in the district (23.8% of the total population are under 16) whom are particularly sensitive to the

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013
[4] https://ubd.bradford.gov.uk/media/1450/briefing-poverty-and-deprivation-october-2018.pdf
[5] https://fingertips.phe.org.uk/search/particulate#page/0/gid/1/pat/6/par/E12000003/ati/102/are/E08000032

effects of poor air quality. They may experience life-long impacts resulting from pollutant exposure in their early years.

For some pollutants the government has set health based objective levels which Local Authorities must comply with. Where these objectives are not met, Local Authorities must declare **Air Quality Management Areas (AQMAs)** and draw up **Air Quality Action Plans (AQAPs)** to improve air quality.

Air Quality Management Areas in Bradford

Bradford has declared four Air Quality Management Areas (AQMAs). These are located close to the city centre at Manningham Lane, Thornton Road, Mayo Avenue / Manchester Road and Shipley Airedale Road. All the AQMAs were originally declared for exceedance of both the annual average and hourly objectives for NO_2. Since the declarations air quality has improved in some areas. At Thornton Road and Mayo Avenue only the annual average objective is still considered to be at risk of exceedance. The AQMA orders for these two AQMAs require amending to reflect this.

There are a number of other locations where NO_2 concentrations are known to be elevated. Monitoring is on-going at these locations and further AQMA declarations may become necessary in the future.

The approximate location of the AQMAs and other areas of concern identified by City of Bradford MDC are shown in Figure 1.

The detailed boundaries of the current AQMAs are shown in Figure 2.

This report presents air quality data for Bradford MDC for the 2018 calendar year.

During 2018 the annual average NO_2 objective continued to be breached at relevant receptor points in the AQMAs located at Manningham Lane and Shipley Airedale Road. There were also exceedances of the annual average NO_2 objective in the Mayo Avenue and Thornton Road AQMAs during 2018. These locations did not have an exceedance of the annual average NO_2 objective in 2017.

The hourly NO_2 objective was not exceeded at any of the AQMAs during 2018. This has been the case for the past four years.

Figure 1: Current AQMAs and additional areas of air quality concern in Bradford

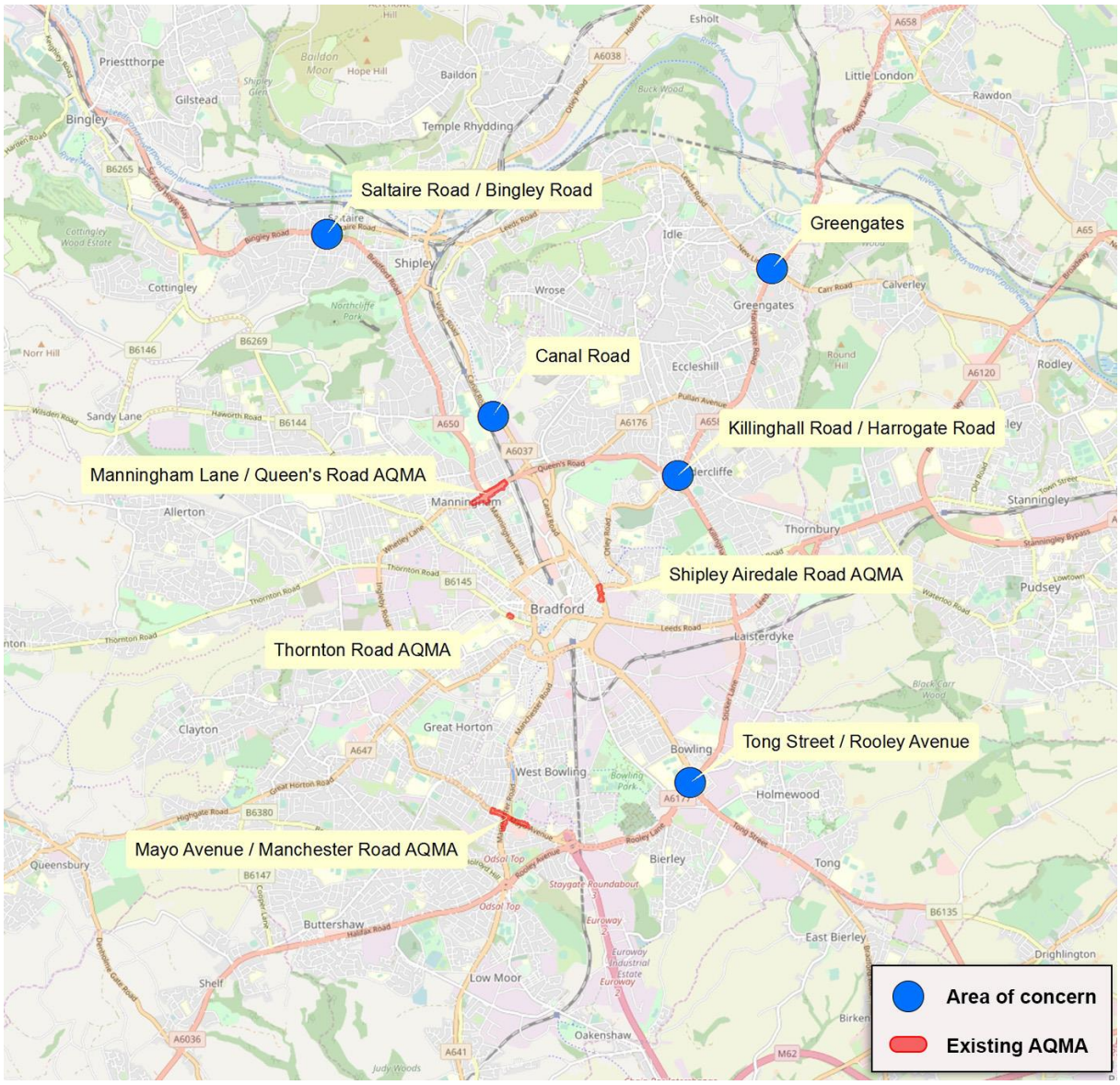
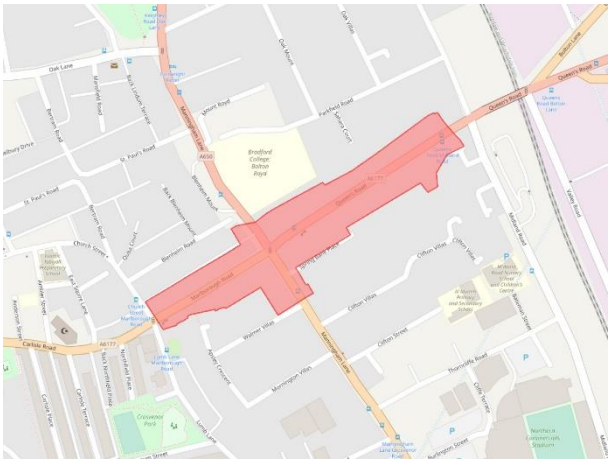
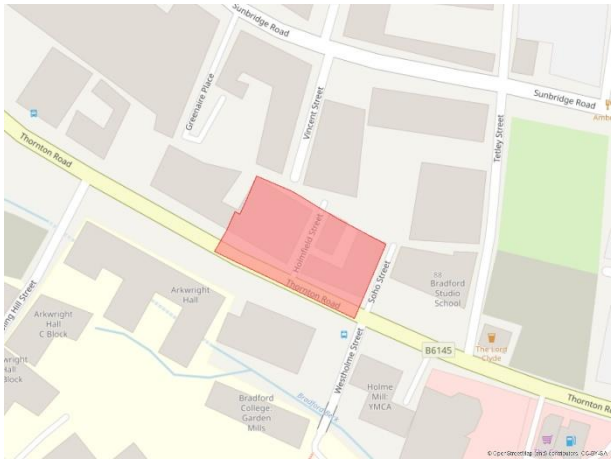


Figure 2: Bradford AQMA boundaries

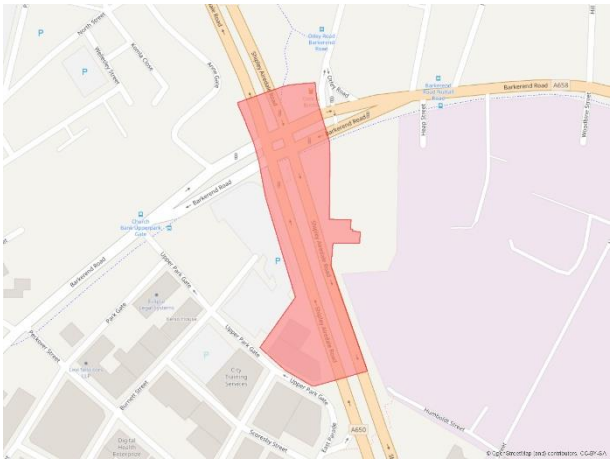
Mayo Avenue / Manchester Road – Order 1



Manningham Lane / Queen's Road – Order 2



Thornton Road – Order 3



Shipley Airedale Road – Order 4

Air quality trends in the AQMAs

Shipley Airedale Road

The annual average NO_2 concentration recorded at the Shipley Airedale Road real time monitoring site in 2018 was 48µg/m^3. This is higher than the value of 40µg/m^3 measured in 2017 but similar to values recorded in the prior three years which ranged from 48 to 54ug/m^3. It was noted in the 2018 ASR that the annual average recorded at the Shipley Airedale Road real time analyser in 2017 may have been compromised by low data capture and a requirement to annualise the data. The 2018 increase in the levels measured (which are more consistent with those prior to 2017) is considered more representative of current conditions at this site.

Data from the nearest diffusion tube (DT12) shows a reduction in NO_2 concentration during 2018 compared with the previous 4 years. The results from this site remain significantly above the annual average objective at 55µg/m^3 (objective level = 40 µg/m^3). A diffusion tube reading of >60µg/m^3 is considered indicative of hourly objective breaches. It is unlikely the hourly objective was breached at site DT12 during 2018.

Diffusion tube data from site DT12 indicates some evidence of a downward trend in NO_2 concentration in this AQMA in recent years, but this is currently not reflected in the real time monitoring results.

Mayo Avenue / Manchester Road

At Mayo Avenue the annual average NO_2 concentration recorded at the real time monitoring site in 2018 was 44µg/m^3. This was higher than the value of 42µg/m^3 recorded in 2017 but is comparable with results for the previous 3 years which ranged from 42 to 46µg/m^3. The average concentration of NO_2 measured at the real time site over the past 5 years is 43µg/m^3. During 2017 additional diffusion tubes were deployed to examine air quality across a wider area of the Mayo Avenue / Manchester Road AQMA. The 2018 results from these additional tubes (DT103 through to DT107) confirm that the annual average NO_2 concentration remains elevated across this area and is still exceeded at some relevant receptor points within this AQMA (DT104 – Mayo Avenue and DT105 – Manchester Road). The hourly objective is no longer at risk within this AQMA. Air quality has not improved significantly at the Mayo Avenue real time monitoring site during the past 5 years.

The current long term trend is unclear but all sites displayed an increase from 2017 to 2018.

Thornton Road

In the 2018 ASR it was reported that the concentration of NO_2 at the Thornton Road real time site had been below the annual average objective for four consecutive years. This was also reflected by diffusion tube data for the immediate area.

The data collected from the real time site in 2018 returned a significantly higher than expected annual average value of 45µg/m^3. This increase was not reflected at the nearby diffusion tube sites which as in previous years returned values in the lower 30's. After a thorough investigation of the 2018 real time data a long term and previously undetected fault with the real time analyser has been identified. This may have resulted in under reporting of the annual average nitrogen dioxide concentration at Thornton Road in the past. Further information on this issue is provided in Annex F of this report.

As a consequence of the long term problem with the real time analyser current conditions and long term trends in the Thornton Road AQMA are unclear. Diffusion tube data continues to indicate that the annual average objective is being met. Monitoring is being continued in this area and will be reviewed again in 2020.

Manningham Lane

Data capture at the Manningham Lane air pollution station was poor during 2018 (40.2%) due to the impact of a fire at the site. Data was only collected for the latter part of the year and has been annualised in accordance with Defra guidance. The resulting annualised value was 51µg/m^3. This value is higher than those recorded in the past three years which have been in the region of 40µg/m^3. Data from the nearest diffusion tube (DT71) did not indicate any increase compared to previous years returning a value of 40µg/m^3. The limited data collection at the real time site (which took place mainly through the autumn and winter) may have resulted in an inflated value despite the application of annualisation.

Data from the other diffusion tube in this area (DT72) remained significantly elevated against the objective value at 66µg/m^3. This is higher than the value of 53 µg/m^3 measured in 2017 but the same as that recorded in 2016.

There is currently no evidence of air quality improvement in the Manningham Road AQMA and it is likely that both the annual average and hourly objective remain at risk of being breached.

Additional areas of air quality concern in Bradford

Since the declaration of the current AQMAs, City of Bradford MDC had identified five additional areas where elevated NO_2 concentrations had been recorded. These are located at:

- Saltaire Road / Bingley Road junction
- Rook Lane / Rooley Lane / Tong Street area
- Harrogate Road / Killinghall Road/ Dudley Hill Road crossroads
- Canal Road
- Greengates crossroads

The 2018 monitoring results indicate that the annual average NO_2 objective continues to be exceeded at two relevant locations on Bingley Road and levels remain border-line with the objective at relevant locations on Tong Street and Killinghall. Further information about current air quality in each of these areas is detailed in section 3 of this report.

Mandated Technical Feasibility Study and Bradford Air Quality Plan Business Case

In addition to the national air quality objectives (which local authorities have a duty to work towards) the UK Government has a legal duty to meet EU air quality standards. The UK has failed to meet these standards in many of its cities. As a result the EU commenced infraction proceedings against the UK in spring 2015.

In April 2015 the UK Government was subject to a Supreme Court Action ruling relating to air quality. Subsequent court challenges have resulted in further rulings against the Government and a requirement to develop new plans to resolve the UK's air quality problems.

A NO_2 reduction plan was produced in 2017 which mandated cities with the worst air quality to undertake technical feasibility studies to identify further measures to improve air quality. The document was challenged in the High Court and

subsequently deemed 'illegally inadequate'. The Government was required to undertake further revisions to the plan to ensure that it is taking all possible steps to deliver the EU air quality objectives in the shortest possible timeframe.

In March 2018, City of Bradford MDC was mandated by Ministerial Direction to complete a technical feasibility study to identify interventions that might bring forward Bradford's compliance with the EU limit values for NO_2. Bradford was one of several 'third wave' local authorities required to undertake this type of study.

Bradford's mandated technical feasibility study was submitted to DEFRA in July 2018. It concluded that a scheme incorporating a form of vehicular access control would be required to bring forward compliance.

The full report can be viewed here:

https://uk-air.defra.gov.uk/library/assets/documents/no2ten/Bradford_FINAL.pdf

Following the outcomes of this initial study Government has served a further Ministerial Direction on City of Bradford MDC. This requires further consideration of the options shortlisted in the initial study and the development of a detailed business case for a new Bradford Air Quality Plan to bring forward compliance in the shortest possible timeframe. The Direction requires that the local authority produces a final business case by 5th October 2019. The development of this business case is currently on-going.

The scale and nature of the measures required to meet the EU limit values are likely to impact on air quality across a wide area of Bradford. This will include the current AQMAs and other areas where AQMA declarations are pending or elevated air quality conditions have been identified.

In the majority of cases the air quality implications of measures likely to be put in place to address the EU limit value exceedances are anticipated to be positive. However, there are risks for traffic to be re-distributed across the road network and for the composition of vehicles to change on some routes.

Due to current uncertainty about the detail of future traffic levels and air quality conditions across the city, City of Bradford MDC has decided to delay revocation of existing AQMAs, or the creation of any new AQMAs, until the outcomes and timescales of the business case and subsequent Bradford Air Quality Plan are known. This will enable air quality resources to be fully concentrated on developing

the air quality plan business case and prevent any unnecessary AQMA declarations or revocations.

Significant challenges to improving air quality in Bradford

Significant key challenges to improving air quality in Bradford are:

- Failure of vehicle manufacturers to reduce emissions as quickly as was previously anticipated. This is considered to be a direct result of inadequate emission control tests for new vehicles and the use of emission test defeat strategies by a number of vehicle manufacturers. Consequently 'on the road emissions' of NO_x from many modern vehicles, particularly Euro 5 diesel cars, are much higher than consumers have previously been led to believe.
- The increased uptake of diesel vehicles in the general vehicle fleet, driven by previous central government taxation polices designed to encourage their purchase.
- Development related "emissions creep", arising from additional vehicle trips linked to development in the city and associated combustion sources for heating and industry.
- Bradford has seen an increase in domestic wood burning, biomass and local electricity generation (CHP and STOR).

Actions to Improve Air Quality in Bradford

The measures currently being taken by the City of Bradford MDC to improve air quality are detailed in the following documents:

- Air Quality Action Plan (2009)
- Air Quality Strategy (2011)
- Bradford Low Emission Strategy (2013)
- West Yorkshire Low Emission Strategy (WYLES)

These documents can be viewed at:

https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/

The approaches employed to currently improve air quality in Bradford are;

a) **Trip reduction** – measures which aim to reduce the overall numbers of journeys taken in motor vehicles across the district. This includes investment in sustainable transport measures, enabling more people to walk, cycle or use public transport. It also incorporates measures that encourage people to share vehicles (such as car share schemes and car clubs) and measures that encourage working or studying from home.

b) **Emission reduction measures** – these are measures that aim to reduce the total emissions from individual vehicles. This can be achieved by fitting emission abatement equipment to existing vehicles, replacing older vehicles with newer ones or by completely changing the technology and fuels used. For example, ultra-low emission vehicles fuelled by electric or gas are much cleaner than those that use diesel. Procuring low emission goods and services is a significant element of this strategy

c) **Planning measures** - these are measures designed to reduce the emission impact of future developments in Bradford, primarily in terms of traffic pollution, but also incorporating heating and other combustion sources, dust generation and industrial processes. The aim is to limit any additional trips to a minimum and ensure that the planning approval process assists in the delivery of an infrastructure required to support the future use of sustainable transport or ultra-low emission vehicles. For example, a developer may be required to provide a new cycle lane and / or electric vehicle recharging points for a new development.

d) **Education and research** - measures that help the local population understand the sources of pollutants, how they impact on their health and how emissions and exposure to air pollutants can be reduced or avoided.

The policy document facilitating air quality improvement and associated emission reductions in Bradford during 2018 was the **Bradford Low Emission Strategy (LES)** adopted in 2013. The strategy ensures that low emission measures and the requirement to improve air quality are at the heart of local decision making processes, driving air quality improvements and attracting inward investment for sustainable transport and low emission technology projects. Progress on delivery of the Bradford LES is reported to the Health and Well Being board, ensuring achievement of the best possible air quality and health outcomes for the whole of the

Bradford population is a key objective, not solely compliance with air quality objectives.

Table 1 summarises air quality improvement measures in Bradford.

Some of the air quality improvement measures undertaken in Bradford during 2018 are outputs from the West Yorkshire Low Emission Strategy (WYLES). This document was fully adopted in Bradford (December 2016) and the strategy is now being delivered across the whole West Yorkshire region. The document can be viewed in full at https://www.bradford.gov.uk/media/3590/west-yorkshire-low-emissions-strategy.pdf

Future actions to improve air quality in Bradford will be significantly determined by the outcome of the air quality plan business case. The initial deadline for completion of this study was October 2019 and is still ongoing at the time of this report. An update on progress will be provided in the 2020 ASR report.

Table 1.0 Bradford Air Quality Improvement Measures

Strategy / Policy Area	Measures undertaken up to and including 2018	Planned progress for 2019
Bradford Low Emission Strategy (LES)	An over-arching City of Bradford MDC internal strategy to improve air quality through integrated policy development focusing on measures to reduce vehicle emissions. Adopted by Full Council, 5th November 2013.	The status and relevance of the Bradford LES will be reviewed following the completion of the air quality plan business case.
West Yorkshire Low Emission Strategy	Bradford MDC has secured funding for, and co-ordinated the development of, the West Yorkshire Low Emission Strategy (WYLES) in partnership with all the West Yorkshire Councils, West Yorkshire Combined Authority (WYCA) and PHE. This is an over-arching county wide strategy to improve air quality in the West Yorkshire region through integrated policy development. Following adoption of the WYLES by City of Bradford MDC in December 2016 the following measures were progressed in 2018. • Continued growth of the West Yorkshire Eco-stars scheme • West Yorkshire LAs and WYCA	A new WYLES project manager was appointed in June 2019 Progress with implementing the WYLES and consequent updating of local policies has been slower than initially planned due to a number of the West Yorkshire authorities having to complete mandated feasibility studies and develop air quality plan business cases during 2018. During 2019 the bus retrofit project and electric taxi project will continue to be implemented and the review of WYLES progress completed.

	successfully obtained joint funding for bus retrofit ~£3m. • Implementation of the electric taxi project commenced through regional partnership working. • CAZ feasibility study in Bradford • Continued consistent low emission mitigation measures applied through the planning process	
Environmental Health & Public Health	In 2015 the results of an innovative Low Emission Zone (LEZ) feasibility study were reported to Bradford Council Elected Members and a decision was taken to investigate the feasibility of implementing a LEZ in Bradford. The decision on whether to implement a LEZ in Bradford has now been superceded by the development of the Bradford air quality plan business case which will determine future air quality improvement policy in Bradford. Mandated feasibility study was completed in 2018. Clean Air Day awareness raising undertaken in 2018 The Public Health research project 'What factors help or hinder adoption of policies to improve air quality?' was completed in 2018.	Development of the Bradford air quality plan business case. School workshops and idling emissions awareness raising on Clean Air Day 2019 Funding obtained to work with health partners including Born In Bradford and national evidence team at Defra to evaluate the Bradford Air Quality Plan Working with Public Health England to develop the air quality work programme for PHE. Through representation on the Local Air Quality Advisory Group (LAQAG at Defra) Bradford are assisting with proposed changes to the Clean Air Act and Air Quality Strategy implementation.
Highways Management & Transport	On-going partnership work with First Bus to encourage minimum Euro emission standards for commercial buses. On-going operation of car club in Bradford during 2018 (including an electric vehicle). Enterprise Car Club[4]	Opening of Bradford Canal Road Cycleway in May 2019 providing a missing link in the Cycle Super-Highway (Bradford-Leeds). https://www.cyclecityconnect.co.uk/our-routes/bradford-canal-road-cycleway/

[4] https://www.enterprisecarclub.co.uk

	Development of £19 million Cycle Super-Highway (Bradford-Leeds) separated cycle lane (first phase opened 2016) Opening of Low Moor railway station in April 2017. This followed opening of Bradford's first new railway station in ten years at Apperley Bridge in December 2015.	On-going liaison with local bus companies to facilitate delivery of improved Euro standards plus retrofit on more routes in Bradford. Current targets agreed with the bus alliance are for 70% of buses to be Euro VI by 2021 and 100% by 2026. These targets may need to be revised following the outcome of the Bradford air quality plan business case development. Commencement of Greengates junction improvement scheme delayed until 2020. Planning for improvement works on Hard Ings Lane, Keighley (including air quality monitoring) Commencement of air quality monitoring prior to improvement works on A650 corridor and West Bradford ring road Work on key corridors to develop Transforming Cities bid in 2019 Planning for new car club locations Consideration of Park and Ride provision as part of air quality plan business case.
Development Control	Continued implementation of Bradford LES low emission planning policies to ensure emission mitigation measures are implemented at the design stage, including the consideration of damage costs for major schemes. Required measures include: • Plug-in vehicle recharging on all schemes where practical – by the end of 2017 in the region of 6,000 charging points had been secured on new development schemes (since policy adoption in 2013) • Introduction of checklist approach to construction dust management plans • Low Emission Strategies/fleet emission standards on commercial schemes • Cycle lanes and infrastructure for	Continued implementation of Bradford and WYLES planning guidance on every relevant application. Increasing input from Public Health to support air quality and health through the planning process Upgrading of minimum standard for EV charging on new housing applications to require purpose built charging unit on all new homes Updating of Bradford LES planning guidance due for completion in 2019

	walking • Electric vehicle provision	
Bradford Council Fleet Management	Measures introduced / completed : • Whole life costs considered in vehicle purchasing • Hybrid electric cars, electric pool cars and vans incorporated into council fleet • Feasibility study of introducing gas/bio-methane infrastructure for Refuse collection vehicles (RCV) fleet • Monthly fuel reports for client departments • Assessment of City of Bradford MDC fleet under Eco-stars fleet recognition scheme	Continued aspiration to have CAZ compliant fleet in City of Bradford MDC (Euro VI/6 in 2021) Development of vehicle advisory group who track CAZ compliance and provide emissions training and advice relating to vehicle use and purchase for departments
Procurement	Vehicle emission assessment matrix developed and incorporated into all relevant tender evaluations through Social Value procurement policy Vehicle emission standards accorded 5% of evaluation score for relevant contract awards	On-going application of vehicle emissions procurement standards in line WY procurement guidance
Taxi Licensing	Ultra-Low Emission Taxi Study as part of OLEV funded EST study across West Yorkshire undertaken in 2015 Measures include consideration of new West Yorkshire wide emission standards to be integrated into the taxi licensing system in accordance with the WYLES A successful regional bid for an Ultra-Low Emission Vehicle taxi scheme was submitted during 2016.	Procurement of supplier for Ultra Low Emission Vehicle taxi scheme completed in 2018 and currently being implemented. Project will include provision of 88 electric vehicle recharging points at railway stations and city centre locations across the region to support the uptake of EVs by the taxi trade. Scheme due for completion in 2021. https://www.westyorks-ca.gov.uk/projects/local-transport-plan-and-other-dft-funding/ulev/
Freight & logistics	Measures to improve vehicle emissions include: • Continued consideration of vehicle emissions through Social Value public procurement • Continued requirement for fleet standards on some new commercial development schemes • Formal launch of Eco-stars scheme completed in 2017	Continued implementation of fleet procurement and low emission planning fleet requirements. Continued operation of WY Eco-stars scheme Additional freight emission reduction measures being developed as part of the air quality plan business case.

Conclusions and Priorities

Bradford has taken a proactive and innovative approach to local air quality management. It was one of the first local authorities in the UK to adopt a Low Emission Strategy (in 2013). Bradford has well established low emission planning and procurement policies and has shared these with partners across the region. To this end Bradford secured funding, project managed and lead the development and adoption of the West Yorkshire Low Emission Strategy. There has been significant local investment in the retrofitting of service and school buses, development of a cycle superhighway and the opening of new railway stations, all reducing the impact of vehicle emissions. City of Bradford MDC also continues to reduce emissions from its own vehicle fleet and is encouraging private partners to match this through the West Yorkshire Eco-stars scheme and new initiatives to reduce taxi emissions.

The latest monitoring shows that some areas of Bradford have experienced slight improvements in annual average air quality concentrations in recent years, but other areas of the city continue to show little or no improvement over the last 5 years. Without further interventions at a local level that reduce transport emissions, long term air quality conditions in Bradford are unlikely to significantly improve.

Bradford has been mandated by the Government to develop a business plan to bring forward compliance with the EU limit values within the shortest possible timeframe. The development of this business plan is currently on-going and may incorporate some form of access restriction for higher emission vehicles. Once a detailed proposal has been defined it will be subject to a full public consultation exercise.

In the period since the original declaration of the AQMAs in 2006, peak hour concentrations of NO_2 across the city have significantly reduced. Peak hour concentrations now rarely exceed the hourly objective level of 200µg/m^3. The declaration of AQMAs for the hourly objective at Thornton Road and Mayo Avenue are no longer relevant. City of Bradford MDC will amend the current AQMA declarations for Thornton Road and Mayo Avenue to clarify that they only apply to exceedances of annual average objectives. Further monitoring is required at Manningham Lane and Shipley Airedale Road before the same action can be considered for these AQMAs.

In the last ASR it was reported that under business as usual conditions the AQMA at Thornton Road could probably be revoked for both the annual average and hourly average objective. The revocation was not actioned due to uncertainty around future conditions on Thornton Road arising from the development of the air quality plan business case. During the preparation of this 2018 ASR report a fault with the real time analyser on Thornton Road was identified which may have resulted in previously reported annual average concentrations for this site being too low. Diffusion tube data for this area continues to indicate that the annual average objective is met but the real time data for 2018 supports the view that the council was correct to keep the annual average AQMA declaration in place. The situation within this AQMA will continue to be monitored and reported and no further action to remove the annual average declaration will be taken until the air quality plan business case is completed and further real time data is available.

In previous ASR reports it has been highlighted that a new AQMA declaration is required around the Bingley Road / Saltaire Road junction and possibly Tong Street. The 2018 data continues to support the requirement for a new AQMA around the Bingley Road / Saltaire Road junction but suggests conditions on Tong Street are now border-line with the objective. If conditions improve further on Tong Street during 2019 a declaration is unlikely to be required at this location.

Under business as usual conditions City of Bradford MDC would progress the AQMA declaration at Bingley Road / Saltaire Road junction as soon as practicable. However, as this area is included in the modelling being undertaken for the development of the air quality plan business case it would be premature to declare it at this time. The area is also under consideration for a major highway improvement scheme and the results of further monitoring and air quality modelling in relation to this are currently awaited.

City of Bradford MDC is proposing a delay to declaring an AQMA around the Bingley Road / Saltaire Road junction until the air quality plan business case study is complete and the outcome of a bid for major highway improvement works is known. If on completion of these two pieces of work the area is still considered to be at risk of breaching air quality objectives the AQMA declaration will be progressed.

Further monitoring data for all the current AQMAs and areas of additional concern will be provided in the 2020 ASR.

In summary the next steps to be taken by City of Bradford MDC are:

- Amend the current AQMA declarations for Mayo Avenue and Thornton Road to remove references to the annual average objective;
- Continue monitoring air quality within the current AQMAs and other areas of concern and provide an update on concentrations in the 2020 ASR report;
- Incorporate the current AQMAs and other areas of identified exceedance in the modelling work being undertaken for the development of the air quality plan business case and work towards the identification of improvements in air quality in these areas;
- Postpone any further AQMA declarations and revocations until the submission of the Bradford air quality plan business case and the consequent expected improvement in longer term air quality conditions across the city can be predicted with greater certainty.

Local engagement and how to get involved

In order to improve air quality in Bradford and reduce exposure to pollution, Bradford MDC advises residents to make simple changes to their everyday life;

- If able, reduce your vehicle use by walking and cycling for shorter journeys, highlighting the value for health and the environment. Consider using the 'walk it' app (https://walkit.com/) which helps plan journeys in Bradford (and other cities). Try and pick routes which are not as heavily trafficked (e.g. through parks and lesser used streets) to reduce the amount of pollution exposure.
- Make the most of public transport as an alternative to using a car, this can save money and reduce impact on the environment. Check out the information on the Council website for local transport provision and see if it can help better plan journeys - https://www.bradford.gov.uk/transport-and-travel/public-transport/public-transport/
- If you have children who are travelling to school consider the advice on the Council website to help make this journey more sustainable and improve their health; https://www.bradford.gov.uk/education-and-skills/travel-assistance/sustainable-travel-to-school/

- Think about how homes are heated and to ensure compliance with the legal requirements for smokeless zones. Residents are advised that if they fail to comply they could risk a fine of up to £1,000 per offence https://www.google.co.uk/#q=defra+smoke+control+areas
- If you live in an urban area, consider buying a 'low nitrogen oxide' boiler the next time it requires replacement.
- If you own a vehicle which is regularly driven in urban areas, think about the impact on the environment when the time comes to replace it. Consider low emission alternatives, such as hybrids and electric vehicles. Although the initial purchase price may seem high in the longer term they may prove more cost effective through reduced fuel and tax costs. Government grants are available to help with the purchase of some low emission vehicles. https://www.gov.uk/plug-in-car-van-grants/eligibility

Whatever vehicle you drive the Council encourages drivers to try and follow the green driving tips below;

Green driving tips

Lift-Share

Check if it is possible to share your vehicle or take a lift to reduce the impact of journeys. Consider using the West Yorkshire lift share website to help with this; https://wy.liftshare.com/

Check your tyres

Under-inflated tyres mean an engine has to work harder and will produce more emissions.

Clear the clutter

Remove unnecessary clutter from your boot and reduce engine workload.

Stick to the speed limit

High speeds produce more emissions. At 70mph a driver could be using up to 15 per cent more fuel than at 50mph.

Slow down as you approach traffic jams

Stop-start traffic jams use more fuel. Slow down early and take your foot off the accelerator.

Don't over-rev

Changing up a gear early can reduce revs. For diesel cars change up when the rev counter reaches 2000rpm. For petrol cars, change up at 2500rpm.

Switch off your engine

If likely to be at a standstill for more than three minutes switch off your engine.

Close windows

Keeping windows closed at higher speeds will use less fuel.

Cut down on air-conditioning

Air-conditioning increases fuel consumption and produces more emissions.

If you would like to see more done to improve air quality in your area then you could contact the local Councillor or MP and tell them about your concerns or ideas. To find out who your local Councillor or MP is and how to contact them;

https://bradford.moderngov.co.uk/mgMemberIndex.aspx?bcr=1

http://www.parliament.uk/mps-lords-and-offices/mps/

For more information on national campaigns to improve air quality and opportunities to undertake your own monitoring visit;

https://www.foe.co.uk/page/air-pollution-campaign-clean-air

http://www.clientearth.org/

http://cleanair.london/

Daily national air quality updates, pollution forecasts and advice about how to protect yourself from the impacts of poor air quality can be found at:

https://uk-air.defra.gov.uk/

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1 Local Air Quality Management

This report provides an overview of air quality in City of Bradford MDC during 2018. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by City of Bradford MDC to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England can be found in **Error! Reference source not found.** in Appendix E.

2 Actions 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 must prepare an Air Quality Action Plan (AQAP) within 12-18 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by City of Bradford MDC can be found in Table 2.1. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/review-and-assessment-of-air-quality-in-the-bradford-metropolitan-district/

Alternatively, see Appendix D: Map(s) of Monitoring Locations and AQMAs, which provides for a map of air quality monitoring locations in relation to the AQMA(s).

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Date of Declaration	Pollutants and Air Quality Objectives	City / Town	One Line Description	Is air quality in the AQMA influenced by roads controlled by Highways England?	Level of Exceedance (maximum monitored/modelled concentration at a location of relevant exposure)				Action Plan		
						At Declaration		Now		Name	Date of Publication	Link
Mayo Avenue / Manchester Road (Order 1)	2006	NO2 Annual Mean	Bradford	Terrace housing	NO	57	µg/m3	44	µg/m3	Bradford Air Quality Action Plan, Bradford Low Emission Strategy , West Yorkshire Low Emission Strategy	2009,2013, 2016	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Manningham Lane / Queen's Road (Order 2)	2006	NO2 Annual Mean	Bradford	Mixed housing	NO	33	µg/m3	66	µg/m3	Bradford Air Quality Action Plan, Bradford Low Emission Strategy , West Yorkshire Low Emission Strategy	2009,2013, 2016	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Thornton Road (Order 3)	2006	NO2 Annual Mean	Bradford	Student housing	NO	35	µg/m3	45	µg/m3	Bradford Air Quality Action Plan, Bradford Low Emission Strategy , West Yorkshire Low Emission Strategy	2009,2013, 2016	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/

Shipley Airedale Road (Order 4)	2006	NO2 Annual Mean	Bradford	Apartments	NO	68	µg/m3	51	µg/m3	Bradford Air Quality Action Plan, Bradford Low Emission Strategy , West Yorkshire Low Emission Strategy	2009,2013, 2016	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Mayo Avenue / Manchester Road (Order 1)	2006	NO2 1 Hour Mean	Bradford	Terrace housing	NO	unknown	µg/m3	153 At monitor	µg/m3	Bradford Air Quality Action Plan, Bradford Low Emission Strategy , West Yorkshire Low Emission Strategy	2009,2013, 2016	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Manningham Lane / Queen's Road (Order 2)	2006	NO2 1 Hour Mean	Bradford	Mixed housing	NO	unknown	µg/m3	153 (at monitor)	µg/m3	Bradford Air Quality Action Plan, Bradford Low Emission Strategy , West Yorkshire Low Emission Strategy	2009,2013, 2016	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/

Thornton Road (Order 3)	2006	NO2 1 Hour Mean	Bradford	Student housing	NO	unknown	µg/m3	187 (at monitor)	µg/m3	Bradford Air Quality Action Plan, Bradford Low Emission Strategy , West Yorkshire Low Emission Strategy	2009,2013, 2016	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/
Shipley Airedale Road (Order 4)	2006	NO2 1 Hour Mean	Bradford	Apartments	NO	unknown	µg/m3	182 (at monitor)	µg/m3	Bradford Air Quality Action Plan, Bradford Low Emission Strategy , West Yorkshire Low Emission Strategy	2009,2013, 2016	https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/

x **City of Bradford MDC confirm the information on UK-Air regarding their AQMA(s) is up to date**

2.2 Progress and Impact of Measures to address Air Quality in City of Bradford MDC

City of Bradford MDC has taken forward a number of direct measures during the current reporting year of 2018 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.2.

More detail on these measures can be found in following documents:

- Air Quality Action Plan (2009)
- Air Quality Strategy (2011)
- Bradford Low Emission Strategy (2013)
- West Yorkshire Low Emission Strategy (WYLES)

These documents can be viewed at:

https://www.bradford.gov.uk/environmental-health-and-pollution/air-quality/air-quality-in-the-bradford-district/

Key previously completed measures are:

- Adoption of Bradford Low Emission Strategy (2013) and West Yorkshire Low Emissions Strategy in (2017). Together these two documents have resulted in:
    - On-going routine application of low emission planning guidance (since 2013) which requires EV charging facilities and construction dust management plan conditions on most planning applications and wider emission mitigation and travel planning on larger developments.
    - Bio-methane / natural gas feasibility study for refuse vehicles (2013)
    - Whole life costing for council fleet vehicle purchases resulting in introduction of hybrid and full electric vans and cars into City of Bradford MDC fleet (since 2014)
    - Completion of West Yorkshire Low Emission Zone feasibility study in 2015 (superceded by Government mandated technical feasibility

studies and development of air quality plan business cases across West Yorkshire).

- £400k secured through Clean Vehicle Technology Fund (CVTF, DfT, 2014/15) to retrofit 26 Euro III commercial, diesel buses with selective catalytic reduction and particle traps (SCRT) in 2015 in partnership with First Bus and Transdev.
- Enterprise car club introduction in Bradford during 2015 (including an electric vehicle).
- Retrofitting of 165 Euro III school buses across West Yorkshire in partnership with West Yorkshire Combined Authority (WYCA) using Clean Bus/Vehicle Technology Fund (DfT) completed in 2016
- Partnership work with First Bus to encourage minimum Euro IV Standard for commercial buses from 2018, with further improved standards for 2020 and beyond, commenced during 2016. First operate 86% of commercial bus routes in Bradford.
- Launch of West Yorkshire Eco-stars scheme in 2017 and continued growth
- West Yorkshire Electric Vehicle Strategy
- Vehicle emission assessment matrix developed and incorporated into all relevant tender evaluations through Social Value procurement policy

Other significant infrastructure improvements in Bradford to assist with sustainable transport provision include:

- Opening of £19 million Cycle Super-Highway (Bradford-Leeds) in 2016 providing 14km of segregated cycle path. A further stretch of the cycle super highway between Shipley and Bradford (Canal Road) was opened in May 2019.
- Opening of new railway stations at Apperley Bridge (December 2015) and Low Moor (April 2017)

In addition City of Bradford MDC has supported a number of public health research projects relating to air quality and health.

City of Bradford MDC expects to pursue the following measures over the course of the next reporting year:

- Junction improvements at Greengates crossroads (now scheduled to commence February 2020)
- Completion of the highways improvement works at Hard Ings Road Keighley (commenced April 2019). Air quality monitoring is on-going in the area to assess the impact of the scheme.

  http://www.howardcivileng.co.uk/hard-ings-road-improvement-scheme/
- Secure funding and finalise plans for major highway improvement scheme between Shipley and Bradford. Air quality baseline monitoring is ongoing in the area.

  https://www.yourvoice.westyorks-ca.gov.uk/bradfordshipley
- Completion of full business case for A6177 Outer Ring Road junction improvement works. Air quality baseline monitoring is ongoing in the area.

  https://www.yourvoice.westyorks-ca.gov.uk/westbradford
- Evaluation and review of consultation on improved access to Leeds / Bradford Airport https://www.yourvoice.westyorks-ca.gov.uk/airport
- Implementation of up to 88 rapid chargers across West Yorkshire region (for use by public and electric taxis)
- https://www.westyorks-ca.gov.uk/projects/priority-3-clean-energy-and-environmental-resilience/ulev-taxi-scheme/
- Completion of Government mandated air quality plan business case (following completion of mandated technical feasibility study in 2018).
- Updating the Bradford LES planning guidance (currently on-going).

Whilst the measures stated above and in Table 2.2 will contribute towards compliance, City of Bradford MDC anticipates that further additional measures (not yet prescribed) may be required to achieve compliance and hence enable the revocation of the AQMAs at Manningham Lane, Mayo Avenue and Shipley Airedale Road. These additional measures are the subject of the development of an on-going air quality plan business case.

The AQMA at Thornton Road had previously been earmarked for revocation (following completion of the air quality plan business case). Due to the issues identified with the real time analyser during the course of preparing this report conditions in this AQMA will now be completely re-assessed taking into account further monitoring data obtained and projections from the air quality plan modelling studies. The AQMA at Thornton Road will not be revoked until the council is confident that the air quality objectives are being met.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	EU Category	EU Classification	Organisations involved and Funding Source	Planning Phase	Implementation Phase	Key Performance Indicator	Reduction in Pollutant / Emission from Measure	Progress to Date	Estimated / Actual Completion Date	Comments / Barriers to implementation
1	On-going implementation and review of the Bradford LES	Policy Guidance and Development Control	Low Emissions Strategy	City of Bradford MDC	Completed 2013	Adopted Nov 2013 Review and Implementation on-going	Update and review of Bradford LES by end of 2017 – on-going	Emissions from all existing and new sources to be reduced as far as possible using measures within Bradford LES	Good	Live document subject to on-going delivery and review in response to national, regional and local policy developments	Measures within the Bradford LES continue to be implemented at a local level. A further full review of the Bradford LES will be required on completion of the air quality plan business case.
2	Adoption of West Yorkshire Low Emission Strategy	Policy Guidance and Development Control	Low Emissions Strategy	City of Bradford MDC in conjunction with other partners	Completed 2016	Adopted Dec 2016. Review and Implementation on-going	Adoption of WYLES by City of Bradford MDC by end of 2016 - met	Emissions from all existing and new sources to be reduced as far as possible across West Yorkshire region using measures within the WYLES.	Good	Live document subject to on-going delivery and review in response to national, regional and local policy developments	The development of the WYLES has been led by City of Bradford MDC. Many of the ideas and concepts within it have their origins within the Bradford LES. A full review of the WYLES will be required on completion of air quality plan business cases across West Yorkshire.
3	Low emission planning guidance	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	City of Bradford MDC	Completed 2013	Adopted Nov 2103 Review and implementation on-going	Number of EV charging points delivered on new development	Emissions from all new developments to be reduced as far as practically	LES planning guidance routinely applied to all planning	Live document subject to on-going delivery and review	Since implementation the LES planning guidance has resulted in the

								possible and opportunities for increased exposure to air pollution minimised.	applications since 2014	in response to national, regional and local policy developments	conditioning of over 5000 EV charging points on new developments and numerous other low emission fleet measures. The Bradford LES planning policy is currently being reviewed to align it with the WYLES planning guidance.
4	LEZ feasibility study	Promoting Low Emission Transport	Low Emission Zone (LEZ)	City of Bradford MDC in conjunction with other partners	Completed 2015	LEZ feasibility study completed and reported to members in 2015	Not applicable	The LEZ feasibility study indicated that an LEZ could reduce NO_x emissions within the outer ring road by 195.6 tonnes	Project superceded by Bradford air quality plan development	Bradford air quality plan business case to be completed by October 2019. This will determine future of LEZ / CAZ policies in Bradford	Council decision to consider the implementation of a LEZ in on hold pending outcome of Government mandated technical feasibility study and air quality plan business case development.
5	WYLES procurement guidance	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	City of Bradford MDC in conjunction with other partners	completed	On-going	Low emission procurement contracts	Emissions in relation to all new procurement contracts to be reduced as far as practically possible. Operators to be rewarded for LEV practices.	LEV procurement policy 5% of award decision as part of procurement policy (social values)	On-going implementation	All procurement decisions (including delivery of goods and services) with a transport or heating impact to be considered in relation to the emissions matrix

6	Identifying barriers to walking to school	Promoting Travel Alternatives	School Travel Plans	City of Bradford MDC and Born in Bradford	completed	On-going	Development of school travel plan toolkit by Dec 2017	Reduction in pollution in all areas, in particular around school gates and playgrounds	Completed	Dec-17	This work has been completed in partnership with Born in Bradford and the Bradford Institute of Health Research (NHS). Papers were published in 2018.
7	Bus retrofit projects	Vehicle Fleet Efficiency	Vehicle Retrofitting programmes	City of Bradford MDC	completed	completed 2015	25 buses successfully retrofitted, 11 in the city centre and 14 on Manningham Lane	Real world (PEMS) emission testing of the buses showed retrofit achieved a 95% reduction in NOx emissions. Improvements in air quality in Manningham Lane.	Completed 2015	Completed 2015	This was possible due to a successful CVTF fund application worth £400,000. The application was supported by evidence from the LEZ study. Future projects will source alternative funding streams where available and operators will be encouraged to invest in their own fleets.
8	Car clubs	Alternatives to private vehicle use	Car Clubs	City of Bradford MDC	completed	scheme operational	Number of registered car club owners	Not quantified	scheme operational	completed	Further car clubs / car club vehicles will be introduced in the district as demand increases. Planning is being used as a measure to facilitate this, particularly on new housing schemes.

9	Cycle Super Highway	Transport Planning and Infrastructure	Cycle network	City of Bradford MDC	completed	opened June 2016	Not identified	Not quantified	Additional Shipley to Bradford (Canal Road) section opened May 2019	completed	None
10	Staff Travel Plan	Promoting Travel Alternatives	Workplace Travel Planning	City of Bradford MDC	Corporate travel plan published 2015	On-going	Reduce single occupancy car trips by 5% over 5 years Reduce car commuter trips by staff from 62% (2014) to 57% by 2029	Not quantified	Staff travel plan in operation. Review scheduled for 2019	On-going delivery and review (first review scheduled for 2019)	Promotion and development of the Travel plan has been slower than expected due to loss of key staff resources
11	Eco-stars Fleet Recognition Scheme	Vehicle Fleet Efficiency	Fleet efficiency and recognitio n schemes	WYLES steering group / City of Bradford MDC	Completed 2015	2016	Number of Bradford fleets joining the scheme	Not quantified	Scheme launched early 2017.	On-going implement ation and developm ent	The introduction of the West Yorkshire ECO-stars scheme is a measure in the WYLES. Scheme is funded by West Yorkshire Combined Authority
12	CNG	Vehicle Fleet Efficiency	City CNG Station	City of Bradford MDC	Feasibility study completed 2013	Implementation date not yet identified	CNG station build	77 tonnes NOx (from 2013 feasibility study)	Feasibility study completed. Vehicle trial completed	No implement ation date identified	Good political support for project but no decision yet made due to funding uncertainties and practical considerations
13	Low emission procurement policies for City of Bradford MDC fleet	Promoting Low Emission Transport	Public Vehicle Procurem ent - Prioritising uptake of	City of Bradford MDC	completed	On-going implementation	Implementati on of WYLES procurement guidance	Reduction of 332t/CO2e 2014/15-2015/16	7 electric vans and 2 electric pool cars with 3 additional charging	On-going application and review of policy	Introduction of whole life costs into vehicle procurement considerations including air

			low emission vehicles						stations		quality damage costs
14	Voluntary emission standards for buses	Promoting Low Emission Transport	Other	City of Bradford MDC / Bus operators	2015 (WYLES measure)	2016 to 2026	Current target is 70% of buses to be Euro VI by 2021 and 100% by 2026.	24.7 tonnes of NOx reduction estimated for previous target of Euro IV by 2018. Revised figure for new target not yet available.	Bus Alliance have now agreed the revised Euro VI targets	Current target by 2026 (subject to outcome of air quality plan business case)	. These targets may need to be revised following the outcome of the air quality plan business case study
15	Delivery of new railway stations at Apperley Bridge and Low Moor	Transport Planning and Infrastructure	Public transport improvements- interchanges stations and services	WYLES	2009 to 2011	2011 to 2017	Passenger numbers for 2018 Apperley Bridge 372,000 Low Moor 133,060 (opening year)	Not quantified	Apperley Bridge opened Dec 2015 Low Moor opened May 2017	complete	Passenger numbers at both stations are expected to grow further
16	Encouraging uptake of low emission taxis	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	City of Bradford MDC / WYCA	2016 - 2017	2018 - 2020	Number of rapid chargers installed across West Yorkshire Region	5.1% of WY taxis replaced with electric equating to an 18% reduction in NOx emissions and a health cost saving of £189,000 per annum (WYCA)	Funding for 88 rapid charge points across WY obtained in 2018. Supplier appointed. Installations to commence during 2019.	2020	Work on going to identify suitable locations for charging points within the various authorities
17	Public awareness	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2015	2016	Number of petition signatories	N/A	Local action taken to promote Clean Air Day during 2018 and	On-going	Raising public awareness through the use of street infographics and air quality and

									2019		health online petition in partnership with Doctors and academics at the University of Leeds. Workshops held in schools for Clean Air Day 2019 and anti-idling awareness undertaken
18	Health and air quality economics	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2015	2016	Toolkit development and workshops to share with stakeholders	Policy influence	Uptake on-going.	completed	Development of CAPTOR toolkit and published papers to quantify the health impact of Low Emission Policy change in partnership with NHS and economics experts at University of York
19	Identifying barriers to Low Emission Policy change	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2016	2017-18	Published papers	Policy influence	completed	completed	Project to identify the barriers to policy change
20	Public health reporting of Air Quality	Public Information	Via other mechanisms	City of Bradford MDC / NHS	2016	On-going	Air quality in key council documents	Policy influence	On-going	On-going	Air quality in the JSNA, directors PH report, Health and Well Being Strategy and Transformation Plan. Raising the profile of air quality and reporting to the Health and Well Being Board.

21	WY Bus retrofit	Vehicle fleet efficiency	Vehicle Retrofitting programmes	City of Bradford MDC/ WYCA	2017	On-going	Retrofit of 63 buses in Bradford	52 tonnes of NOx from WY bus fleet (total of 230 buses to be retrofitted)	On-going	2020	Competition to invite bus companies to apply for retrofit now open Further retrofit bids submitted during 2019

2.3 $PM_{2.5}$ – Local Authority Approach to Reducing Emissions and/or Concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

In Bradford, emissions of man-made fine particles $PM_{2.5}$ are estimated to cause 4.2% of total mortality, representing 2,300 years of life lost. Road transport emissions are the most significant source of fine particulates, leading to exceedances, but locally elevated concentrations can also arise from biomass combustion, heating, industry and wind-blown dust. The World Health Organisation (WHO) classifies diesel exhaust emissions as carcinogenic.

No areas within the Bradford district are considered likely to exceed the EU Limit Value for $PM_{2.5}$ (annual average concentration of 25µg/m^3) but there are areas, near to major roads, experiencing concentrations of $PM_{2.5}$ which exceed the recommended World Health Organisation (WHO) target level of 10µg/m^3.

There are marked differences in people's health within the Bradford district indicating the existence of significant health inequalities. For example, people living in Wharfedale to the north of the district typically live five years longer than people living in Tong in the south. Similarly, when the Bradford district is compared to the rest of the UK, average life expectancy is reduced. In Bradford there are more deaths as a resulting from smoking, cancer, heart disease, and strokes, and higher rates of mortality in children, than in many other cities.

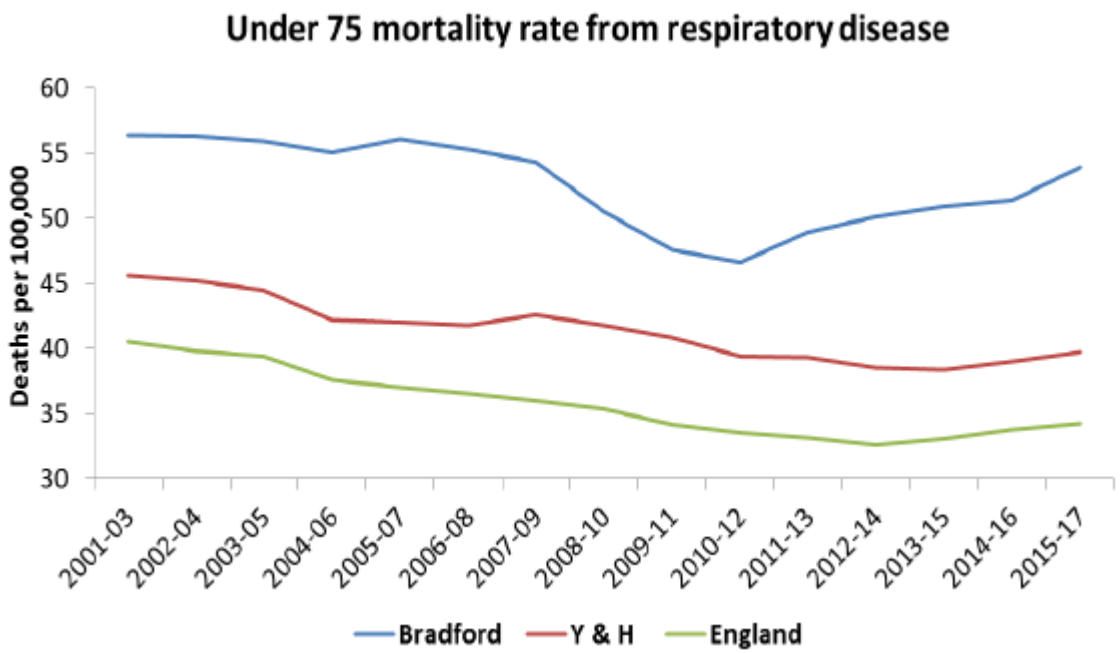
Figure 3[5] shows the under 75 mortality rate from all respiratory disease in Bradford. Although the under 75 mortality rate from respiratory disease in Bradford District has decreased overall since 2001, in recent years rates have begun to increase.

Bradford District continues to have a higher mortality rate from respiratory disease than Yorkshire & Humber and England.

[5] JSNA report on Respiratory Disease Mortality in Bradford, City of Bradford MDC (2018) https://jsna.bradford.gov.uk/documents/Public%20Health%20Intelligence%20resources/Public%20Health%20Intelligence%20Bulletins/Under%2075%20Respiratory%20Disease%20mortality%20-%20December%202018.pdf

The gap between England and Bradford District for this measure has increased over time.

Figure 3: Under 75 mortality rate from respiratory disease



Through research carried out by environmental epidemiologists at the Bradford Institute of Health Research (BIHR) many of these illnesses have been proven to have direct linkages to local air pollution exposure. The data demonstrates that Bradford has a higher rate of 'at risk' people whom will be more vulnerable to the ill-health effects associated with air pollution exposure.

Within the City of Bradford MDC, air quality and public health specialists collaborate to deliver the key outcomes in the Bradford LES and the WYLES (as detailed in table 1). They are supported by colleagues from other Council departments such as transport, planning, highways, fleet management and procurement.

Within Bradford there is a strong emphasis on improving the understanding of how air pollution impacts on health, and effectively communicating this to other professionals and members of the public.

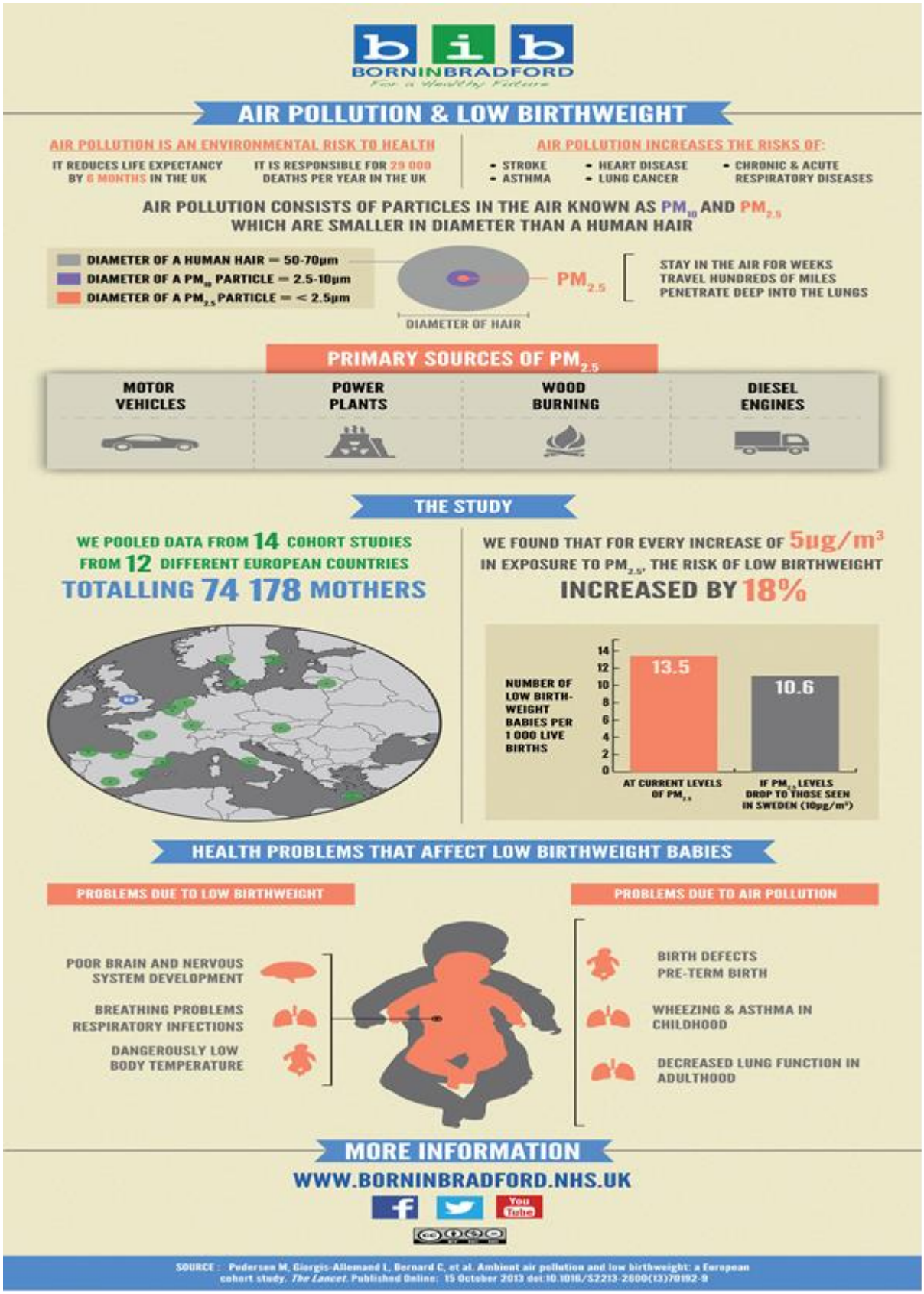
The Public Health Department has funded $PM_{2.5}$ monitoring at three of the existing air pollution stations (Bingley, Keighley and Shipley Airedale Road). The data is used to inform major research programmes (such as the 'Born in Bradford (BiB)' and daily updates are provided to the public via the council's website.

Born in Bradford is one of the largest and most important medical research studies currently being undertaken in the UK. It is tracking the lives of 13,500 Bradford born babies (and their families) to ascertain more about the causes of childhood illness. The work has already identified a number of important linkages between air pollution exposure and health as detailed in the info-graphic below (figure 4).

The Bradford LES and WYLES measures which aim to reduce emissions from diesel vehicles and biomass boilers will be the most effective at reducing local $PM_{2.5}$ emissions (as these are the main sources of this pollutant in Bradford).

Further air quality improvement measures will be presented in the Bradford air quality plan business case (currently in preparation).

Figure 4: Outcomes from BiB study



3 Air Quality Monitoring Data and Comparison with Air Quality Objectives and National Compliance

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how it compares with objectives.

City of Bradford MDC undertook automatic (continuous) monitoring at 7 sites during 2018. Table A.1 in Appendix A shows the details of the sites. NB. Local authorities do not have to report annually on the following pollutants: 1,3 butadiene, benzene, carbon monoxide and lead unless local circumstances indicate there is a problem.

National monitoring results are available at https://uk-air.defra.gov.uk/interactive-map

Maps showing the location of the monitoring sites are provided in Appendix D. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

3.1.2 Non-Automatic Monitoring Sites

City of Bradford MDC undertook non- automatic (passive) monitoring of NO_2 at 55 sites during 2018. Table A.2 in Appendix A details the sites.

Maps showing the location of the monitoring sites are provided in Appendix D.

Further details on Quality Assurance/Quality Control (QA/QC) for the diffusion tubes, including bias adjustments and any other adjustments applied (e.g.“annualisation” and/or distance correction), are included in Appendix C.

3.2 Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, “annualisation” and distance correction. Further details on adjustments are provided in Appendix C.

3.2.1 Nitrogen Dioxide (NO_2)

Table A.3 in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3. . It has not been corrected for distance to the nearest receptor.

For diffusion tubes, the full 2018 dataset of monthly mean values is provided in Appendix B. This data includes both the annual mean at the monitoring point and the distance corrected annual mean at the nearest relevant receptor point.

Table A.4 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past 5 years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year.

Results for Manningham Lane AQMA (2018)

Map 2 in Annex D details the location of the monitoring undertaken in the Manningham Lane AQMA during 2018. The results from these sites are as follows:

Results for Manningham Lane AQMA (2018)

Site	Type	Bias corrected annual average concentration at monitoring point (µg/m^3)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m^3)	Maximum hourly concentration at monitoring point (µg/m^3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60µg/m^3)?
CM3	Real Time	**51**	41	153	0	n/a
DT71	Diffusion Tube	**40**	34	n/a	n/a	no
DT72	Diffusion Tube	**66**	**66**	n/a	n/a	yes

Data capture at the Manningham Lane air pollution station was poor during 2018 (40.2%) due to the impact of a fire at the site. Data was only collected for the latter part of the year and has been annualised in accordance with Defra guidance (see Appendix C). The resulting annualised value was 51µg/m^3. This value is higher than those recorded in the past three years which have been in the region of 40µg/m^3.

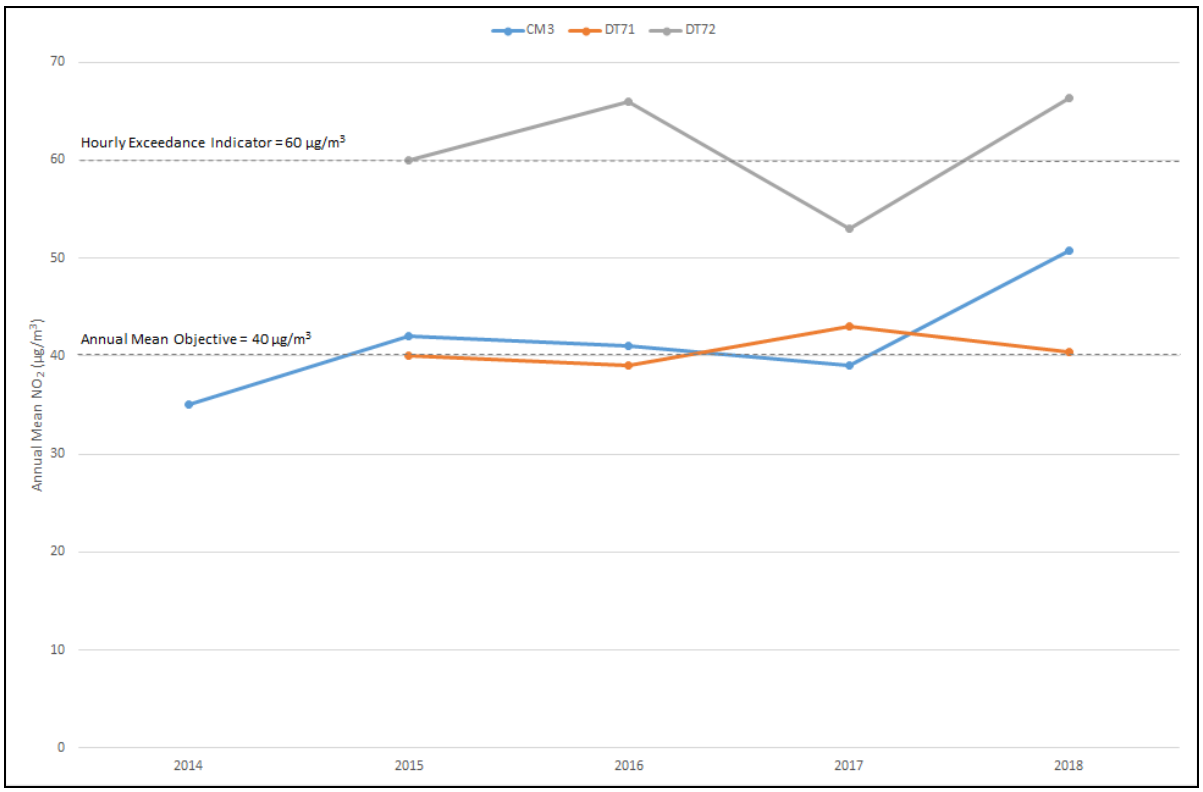
Data from the nearest diffusion tube (DT71) did not indicate any increase compared to previous years returning a value of 40µg/m^3. The limited data collection at the real time site (which took place mainly through the autumn and winter) may have resulted in an inflated value despite the application of annualisation.

The nearest relevant receptor point to the real time monitoring site (and tube DT71) is a house façade located approximately 4m back from the monitoring position. The distance corrected results for CM3 and DT71 for 2018 were 41µg/m^3 and 34µg/m^3 respectively. This indicates a possibility of the objective level being exceeded at the house façade but taking into account the limited data capture from the real time site during 2018 and results from previous years it is considered that concentrations at the relevant receptor are most likely to be just below the objective at present. There is unlikely to be any exceedance of the hourly objective at the relevant receptor point.

The other diffusion tube located within this AQMA (DT72) recorded a concentration of 66µg/m^3 during 2018. This tube is located at a relevant location (post directly in line with front façade of the nearest residential property) and does not require distance correction. The value of 66µg/m^3 was higher than the value of 53 µg/m^3 measured in 2017 but the same as that recorded in 2016. Annual average concentrations >60 µg/m^3 are indicative of breaches of the hourly as well as the annual average objective.

Figure 5 summarises the Manningham Lane AQMA monitoring results (at the monitoring position) for the last 5 years . There is little evidence of any major improvement in air quality within this AQMA during this period and it is likely that both the annual average and hourly objective remain at risk of being breached.

Figure 5 – Manningham Lane 5 year trend



Results for Shipley Airedale Road AQMA (2017)

Map 3 in Annex D details the location of the monitoring undertaken in the Shipley Airedale Road AQMA during 2018. The results from these sites are as follows:

Site	Type	Bias corrected annual average concentration at monitoring point (µg/m^3)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) (µg/m^3)	Maximum hourly concentration at monitoring point (µg/m^3)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60µg/m^3)?
CM6	Real Time	**48**	**44**	182	0	n/a
DT12	Diffusion Tube	**55**	**51**	n/a	n/a	no

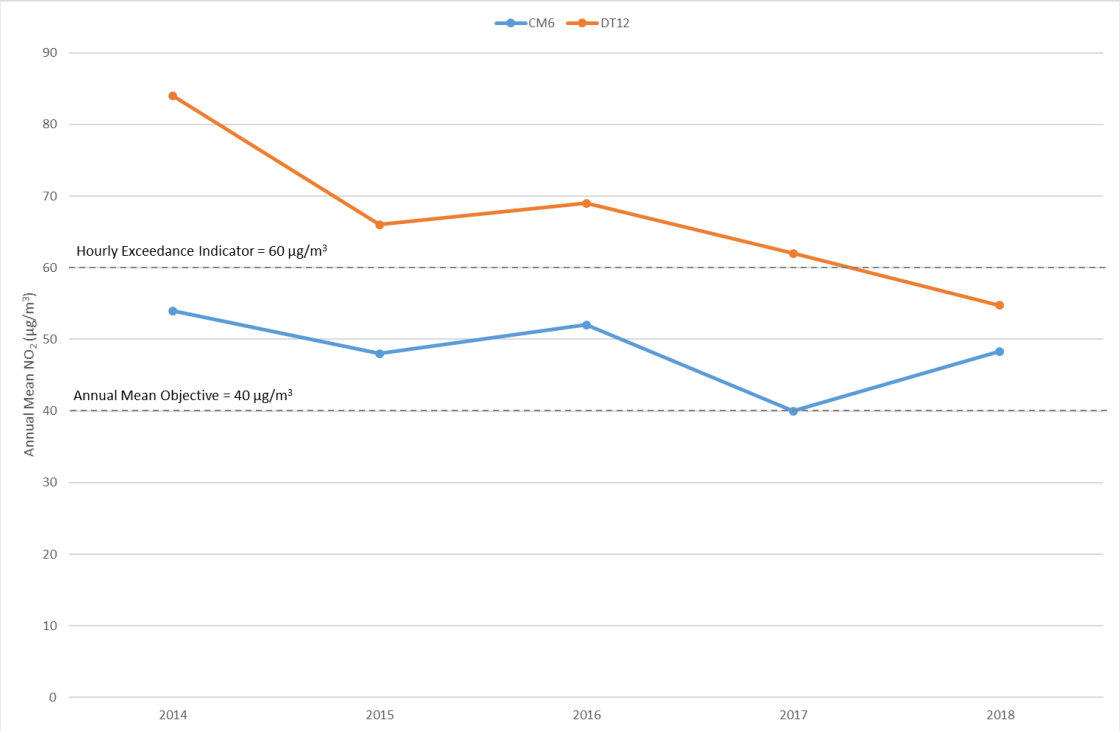
Both the Shipley Airedale Road monitoring sites recorded concentrations above the annual average objective for NO_2 at the monitoring sites in 2018. When corrected for distance to the nearest relevant receptors the concentrations remained above the objective level for both monitoring sites.

The annual average NO_2 concentration recorded at the Shipley Airedale Road real time monitoring site in 2018 was 48µg/m^3. This is higher than the value of 40 µg/m^3 measured in 2017 but similar to values recorded in the prior three years which ranged from 48 to 54ug/m^3. It was reported in the 2018 ASR that the annual average recorded at the Shipley Airedale Road real time analyser in 2017 may have been compromised by low data capture and a requirement to annualise the data. The 2018 increase in the levels measured (which are more consistent with those prior to 2017) is considered more representative of current conditions at this site.

Data from the nearest diffusion tube (DT12) shows a reduction in NO_2 concentration during 2018 compared with the previous 4 years. The results from this site remain significantly above the annual average objective at 55µg/m^3 (objective level = 40 µg/m^3). A diffusion tube reading of >60µg/m^3 is considered indicative of hourly objective breaches. It is unlikely the hourly objective was breached at site DT12 during 2018 but may have been in previous years.

Figure 6 below details the 5 year trend for the monitoring sites in the Shipley Airedale Road AQMA (at the monitoring locations). Diffusion tube data from site DT12 indicates evidence of a downward trend in NO_2 concentration in this AQMA in recent years, but this is not reflected in the real time monitoring results.

Figure 6 - Shipley Airedale Road 5 year trend



On the basis of these results the AQMA declaration at Shipley Airedale Road is still considered relevant for the annual average objective. Whilst the hourly objective is unlikely to have been breached during 2018, concentrations of NO_2 within the AQMA remain significantly elevated above the annual average objective and further monitoring is considered necessary to confirm long term compliance with the hourly objective.

Results for Mayo Avenue AQMA (2017)

Map 4 in Annex D details the location of the monitoring undertaken in the Mayo Avenue / Manchester Road AQMA during 2018.

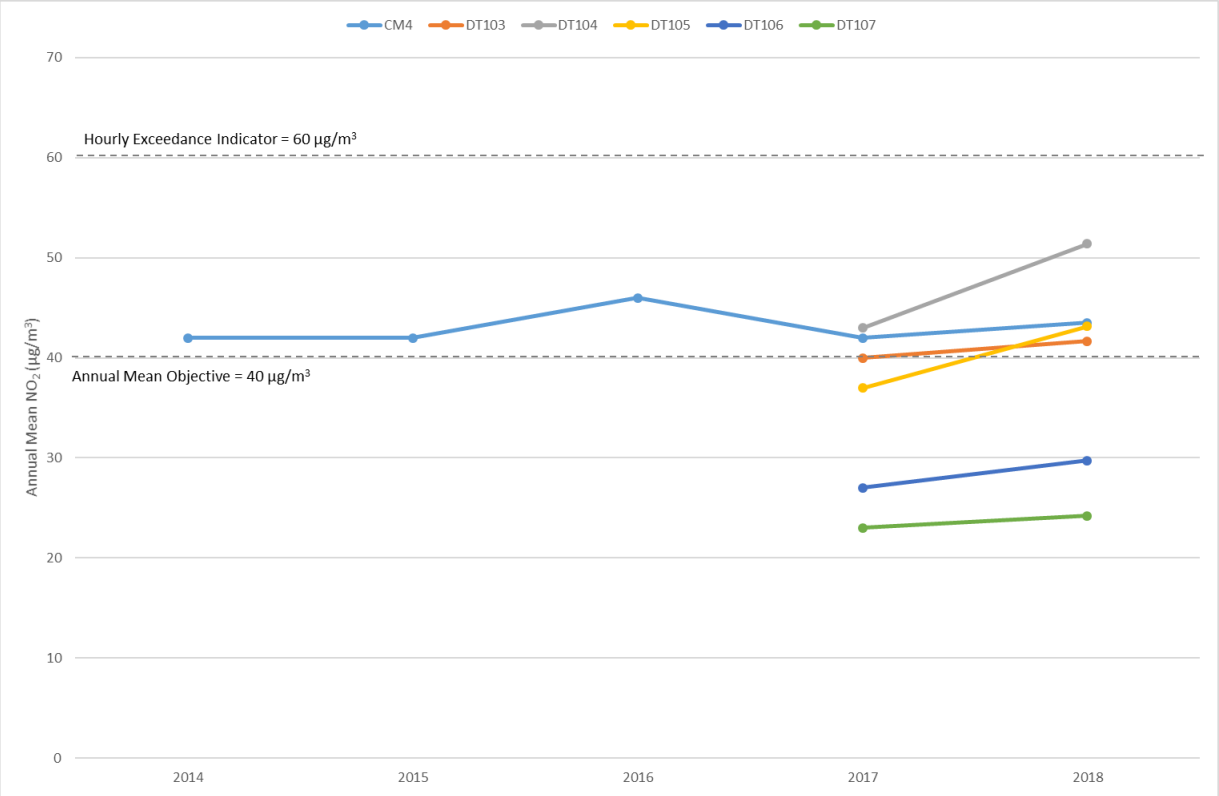
As detailed in the 2018 ASR report the extent of monitoring in this AQMA has been increased with the addition of 5 new diffusion tube sites. The results from all the current monitoring locations within the Mayo Avenue AQMA are as follows:

Site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) ($\mu g/m^3$)	Maximum hourly concentration at monitoring point ($\mu g/m^3$)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60$\mu g/m^3$)?
CM4	Real time	**44**	39	153	0	n/a
DT103	Diffusion tube	**42**	36	n/a	n/a	no
DT104	Diffusion tube	**51**	**44**	n/a	n/a	no
DT105	Diffusion tube	**43**	**43**	n/a	n/a	no
DT106	Diffusion tube	30	28	n/a	n/a	no
DT107	Diffusion tube	24	24	n/a	n/a	no

As in 2017 there is good correlation between the real time station (CM4) and diffusion tube DT103 which is located close by. Both these locations indicate that the annual average nitrogen dioxide objective is just met at the front facades of the terrace housing behind (as was the case in 2017). Tube DT104 has returned a higher result for 2018 increasing from 43µg/m^3 in 2017 to 51µg/m^3 in 2018. The distance corrected value for tube DT104 indicates a breach of the annual average objective at the terrace housing façade in 2018. A breach of the annual average objective was also recorded at site DT105 during 2018 with a value of 43µg/m^3 predicted for the nearby housing on Manchester Road. Within the wider AQMA concentrations were found to be lower and well within the objective levels. As in previous years it is unlikely the hourly objective was exceeded within the Mayo Avenue AQMA during 2018.

Figure 7 details the 5 year trend for the real time monitoring site (CM4) and two year trend for the additional monitoring sites. Air quality has not significantly improved at the Mayo Avenue real time monitoring site during the past 5 years. The current long term trend is unclear but all sites displayed an increase from 2017 to 2018.

Figure 7 - Mayo Avenue 5 year trend



On the basis of these results the AQMA declaration for the annual average NO_2 objective at Mayo Avenue is still considered relevant and will remain in place subject to further review. The hourly objective is no longer considered at risk of being breached and the AQMA order for this AQMA will be amended to reflect this improvement.

Results for Thornton Road AQMA (2017)

Map 5 in Annex D details the location of the monitoring undertaken in the Thornton Road AQMA during 2018.

As detailed in the 2018 ASR report the extent of monitoring in this AQMA has recently been increased with the addition of 3 new diffusion tube sites.

The table below shows the concentrations of NO_2 monitored in the Thornton Road area during 2018.

Site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) ($\mu g/m^3$)	Maximum hourly concentration at monitoring point ($\mu g/m^3$)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60µg/m^3)?
CM5	Real time	**45**	**45**	187	0	n/a
DT108	Diffusion tube	33	33	n/a	n/a	no
DT109	Diffusion tube	34	34	n/a	n/a	no
DT110 (adjacent to AQMA)	Diffusion tube	32	31	n/a	n/a	no

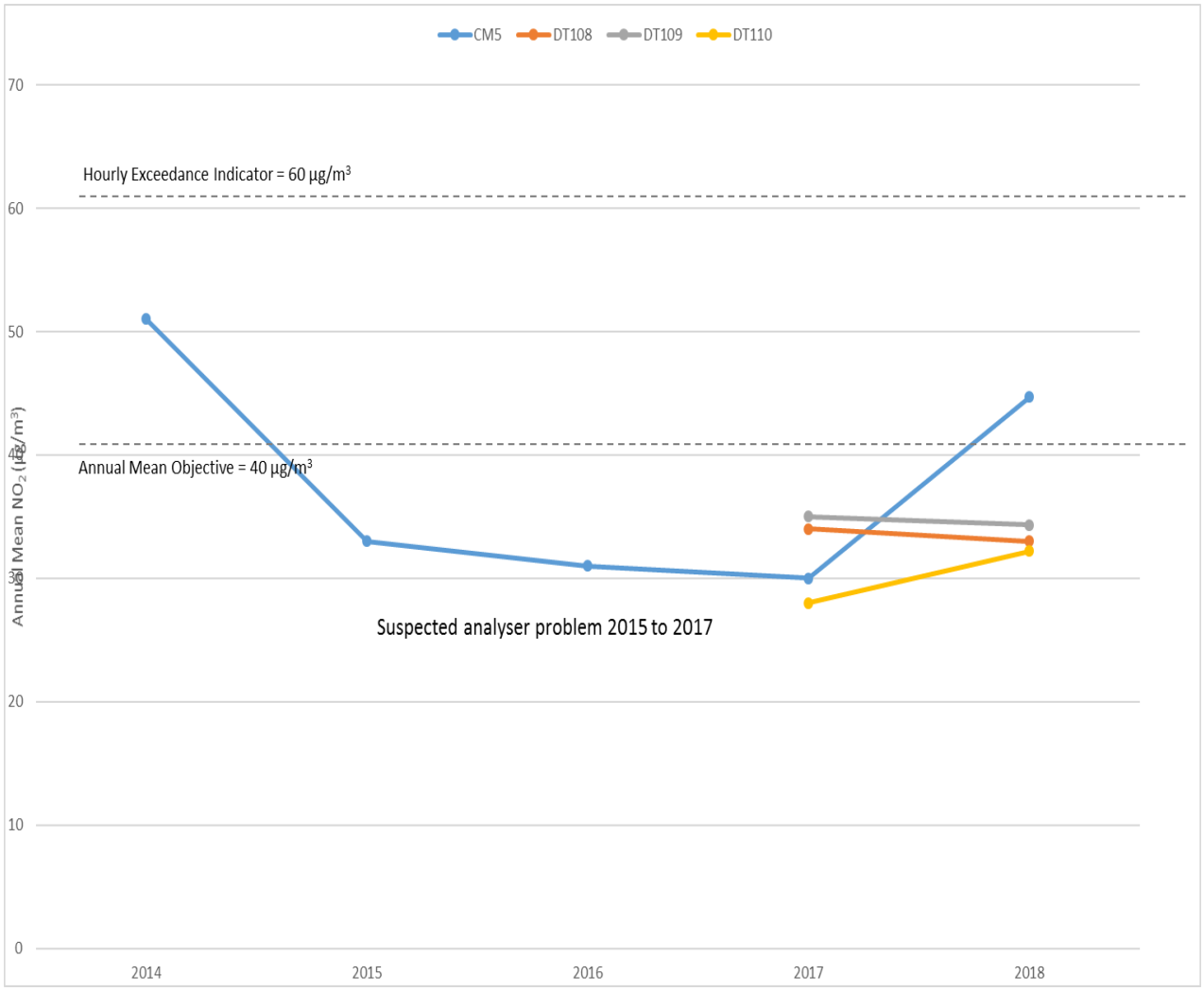
In the 2018 ASR it was reported that the concentration of NO_2 at the Thornton Road real time site had been below the annual average objective for four consecutive years. This was also reflected by diffusion tube data for the immediate area.

The data collected from the real time site in 2018 returned a significantly higher than expected annual average value of 45µg/m^3. This increase was not reflected at the nearby diffusion tube sites which as in previous years returned values in the lower 30's. After a thorough investigation of the 2018 real time data a long term and previously undetected fault with the real time analyser was identified. This may have resulted in under reporting of the annual average NO_2 concentration at Thornton Road in the past. Further information on this issue is provided in Annex F of this report.

Due to the long term problem with the real time analyser current conditions and long term trends in the Thornton Road AQMA are unclear. Diffusion tube data continues to indicate that the annual average objective is being met. Monitoring is being continued in this area and will be subject to further review.

Figure 8 below details the 5 year trend for the real time monitoring site (CM4) and two year trend for the additional monitoring sites on Thornton Road. The trend results detail the significant increase in the annual average objective recorded at the real time site in 2018 compared with recent years. Given this anomaly in the real time data it should be viewed with caution. The recently collected diffusion tube data is more consistent and currently indicates the objectives are being met within some parts of the AQMA.

Figure 8 - Thornton Road 5 year trend



The AQMA at Thornton Road had previously been earmarked for revocation (following completion of the air quality plan business case). As a consequence of the issues identified with the real time analyser during the course of preparing this report conditions in this AQMA will now be completely re-assessed taking into account further monitoring data obtained during 2019 and projections from the air quality plan

modelling studies. The AQMA at Thornton Road will not be revoked until the council is confident that the air quality objectives are being met.

Trends in urban background air quality in Bradford

Urban background air pollution levels in Bradford have previously been reported for two real time locations, Keighley and Bingley. The Bingley site was relocated to a roadside location on Tong Street in 2016 to help investigate possible exceedances of the annual average NO_2 objective in this area. Consequently only urban background real time data from Keighley was available for this report.

The Keighley real time monitoring site (CM2) is representative of an urban centre being located about 5m back from the nearest road in the centre of Keighley. There are three diffusion tubes co-located with the inlet (DT68, DT69, DT70).

In addition to the Keighley urban centre site there is a background diffusion tube (DT21) located on Prospect Street. This tube is located at a significant distance from the major road network and is representative of sub-urban background concentrations.

The 2018 results for the Keighley sites are detailed in the table below.

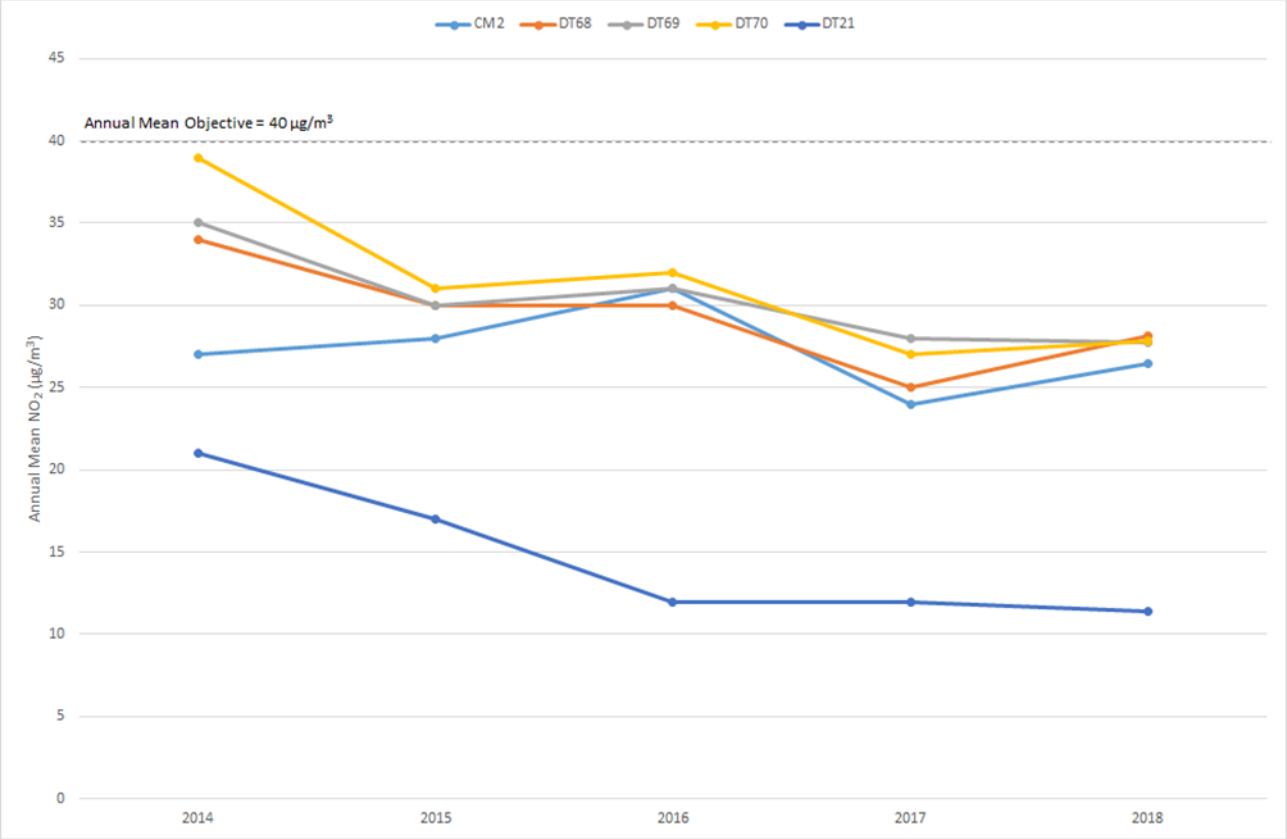
The location of the Keighley monitoring sites are shown on map 6 in Annex D.

Site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) ($\mu g/m^3$)	Maximum hourly concentration at monitoring point ($\mu g/m^3$)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60$\mu g/m^3$)?
CM2	Real time	27	n/a	90	0	n/a
DT68	Diffusion tube	28	28	n/a	n/a	no
DT69	Diffusion tube	28	28	n/a	n/a	no
DT70	Diffusion tube	28	28	n/a	n/a	no

DT21	Diffusion tube	11	11	n/a	n/a	no

During 2018 there was good correlation between the real time analyser and the three co-located diffusion tubes. The levels recorded were slightly higher than those recorded in 2017 but similar to those in previous years. The five year trend is displayed below. There were no exceedances of the annual average or hourly objectives at any of these monitoring locations during 2018.

Figure 9 - Keighley 5 year trend



The 2018 annual average concentration at the sub-urban background site (DT21) was the lowest recorded value for 5 years. When viewed over a 5 year period the Keighley results show a general improvement in urban background concentrations of NO_2.

Compliance with NO_2 hourly objective (diffusion tubes)

The diffusion tube monitoring undertaken in 2018 identified only one site with an annual average concentrations above 60µg/m^3 (DT72 – Queen's Road). This tube is located adjacent to a residential façade and does not require distance correcting. The monitoring site is close to traffic lights at a major junction and on an incline. The site has a history of high readings and is already located within the Manningham Lane AQMA.

Compliance with annual average NO_2 objective (diffusion tubes)

The diffusion tube monitoring undertaken in 2018 identified the following sites as having exceedance of the 40 µg/m^3 annual average objective at relevant receptor points (based on distance corrected results as shown in table B.1).

Site ID	Location	2018 value at relevant receptor point µg/m^3	Has this tube exceeded the annual average objective previously?	Is it in an AQMA?
DT12	Treadwell Mills	51	yes	yes
DT31	80 Bradford Road	41	yes	no
DT50	Bradford Road	50	yes	no
DT72	Queen's Road	53	yes	yes
DT104	Mayo Avenue	44	no	yes
DT105	Manchester Road	43	yes	yes

The following sites were at the objective levels of 40µg/m^3 (at nearest relevant receptor)

- DT64 Tong Street

The following tubes exceeded the annual average objective at the monitoring site but are not associated with relevant locations:

- DT73 – Canal Road garden centre

The following tubes were approaching the annual average objective at relevant locations (38µg/m^3 or greater)

- DT91 – Saltaire Road / Dove Street
- DT42 – Killinghall Road

The diffusion tube monitoring undertaken during 2018 did not highlight any additional areas of air quality concern in Bradford (over and above those identified in the 2018 ASR)

Update on areas of air quality concern in Bradford (outside AQMAs)

The 2018 ASR report identifies the following additional areas of air quality concern.

- Saltaire Road / Bingley Road junction
- Rook Lane / Rooley Lane / Tong Street area
- Harrogate Road / Killinghall Road/ Dudley Hill Road crossroads
- Canal Road
- Greengates junction

Current situation Saltaire Road / Bingley Road junction

Map 7 (Appendix D) displays the location of the diffusion tubes around the Saltaire Road / Bingley Road junction. As previously reported the number of monitoring sites in this area was increased during 2017 to investigate the extent of the exceedance of the annual average NO_2 objective along Bingley Road.

The 2018 results for these sites are shown in the table below:

Site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) ($\mu g/m^3$)	Maximum hourly concentration at monitoring point ($\mu g/m^3$)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60µg/m^3)?
DT30	Diffusion tube	**40**	36	n/a	n/a	no
DT31	Diffusion tube	**51**	**41**	n/a	n/a	no
DT49	Diffusion tube	33	28	n/a	n/a	no
DT50	Diffusion tube	**58**	**50**	n/a	n/a	no
DT91	Diffusion tube	38	38	n/a	n/a	no
DT101	Diffusion tube	**42**	31	n/a	n/a	no
DT102	Diffusion tube	**46**	35	n/a	n/a	no

These results show that exceedances of the annual average NO_2 objective continued to arise at relevant receptor points in this area during 2018.

Figure 10 - Trends around Saltaire Road / Bingley Road junction

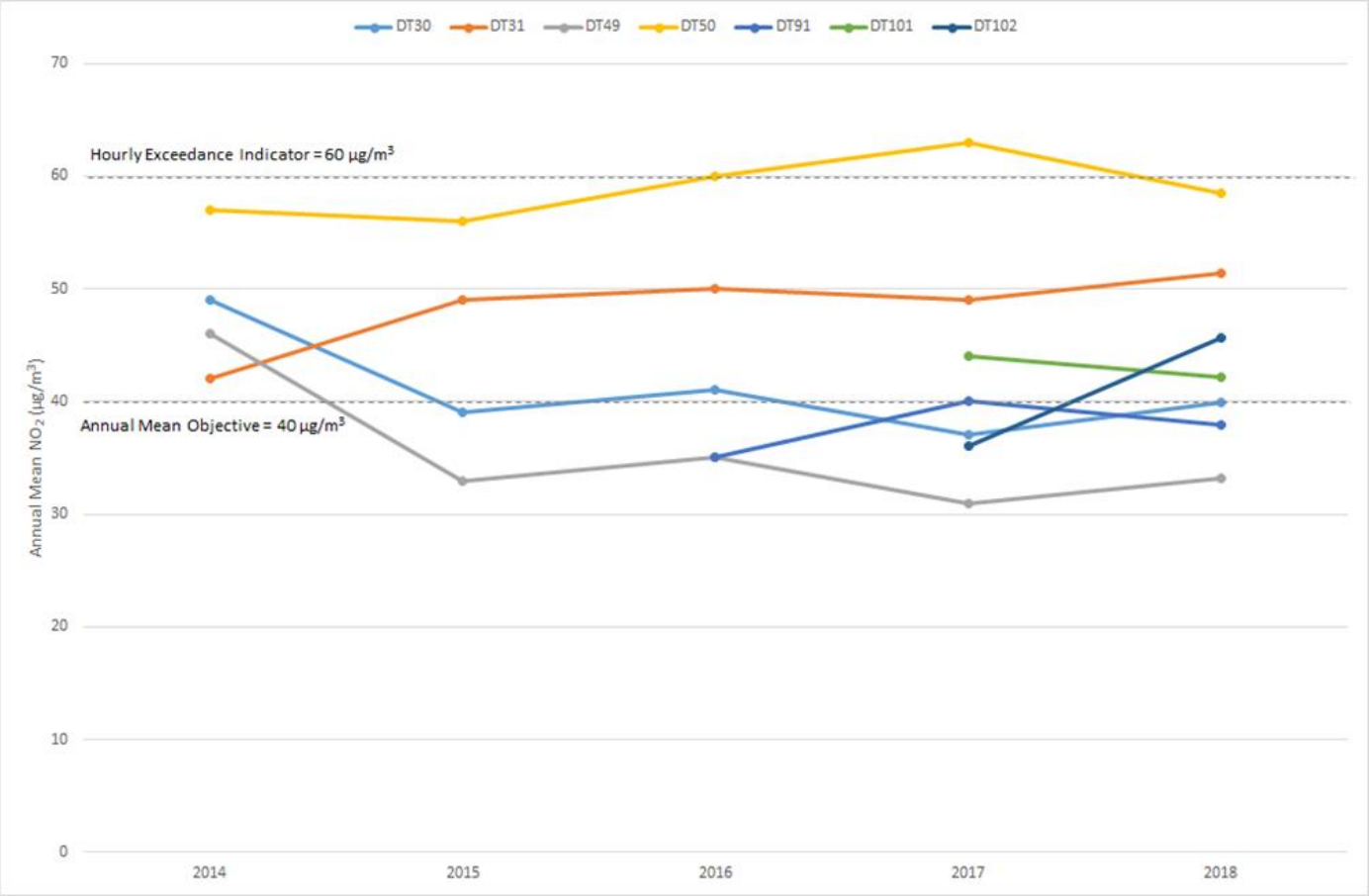


Figure 10 details the bias corrected measured value at monitoring sites in the Saltaire Road / Bingley Road area (with no distance correction applied). Over a 5 year period the NO_2 concentration on Bingley Road (tubes DT31 and DT50) has not significantly improved and in recent years appears to have increased. The increase occurred mainly after 2014 which coincides with the junction being developed from a roundabout to a signal controlled crossroads. The result for DT50 in 2018 was lower than in the previous year but still remains significantly elevated above the 40µg/m^3 objective level. In contrast tubes DT30 and DT49 (on Saltaire Road and Moorhead Lane respectively) show a marked reduction in NO_2 concentration between 2014 and 2017 but both these sites recorded higher concentrations in 2018 than in 2017. Increased concentrations between 2017 and 2018 were also observed at a number of other locations near the junction. These changes may have resulted from changes in traffic signal timings implemented in an attempt to reduce the very high concentrations at site DT50.

The additional tubes recently introduced into this area (DT101 and DT102) continue to indicate that the air quality objective is met at relevant locations further away from the junction. Based on the most recent data any AQMA declared in this location would only be required to cover properties in very close proximity to the junction.

The area around the Saltaire Road and Bingley Road is included in the modelling work being undertaken as part of the air quality plan business case study. The types of measures being considered in this study have the potential to reduce concentrations of NO_2 in this area and bring it into compliance.

There is no immediate stand-alone solution to improve air quality in this area which could be implemented ahead of the measures being developed in the air quality plan business case. The declaration of a further AQMA whilst the air quality plan business case development is on-going would create unnecessary bureaucracy during a period when Bradford is already working towards the identification of a holistic air quality solution for the city. If air quality issues are predicted to remain in this area, irrespective of measures in the final air quality plan, then it will be appropriate to declare an AQMA at that time.

The impact of the Shipley corridor highway improvement scheme on this area is also currently under consideration. https://www.westyorks-ca.gov.uk/projects/west-yorkshire-plus-transport-fund/bradford-to-shipley-corridor/

A further update on air quality in this area will be provided in the 2020 ASR report.

Current situation Rook Lane / Rooley Lane /Tong Street area

The distance corrected results for diffusion tube monitoring in this area during 2018 are shown in the table below. The locations of these tubes are shown on map 8 (Annex D).

Site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) ($\mu g/m^3$)	Maximum hourly concentration at monitoring point ($\mu g/m^3$)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60µg/m^3)?
CM7	Real time	38	36	126	0	n/a
CM8	Real time	34	34	113	0	n/a
DT45	Diffusion tube	32	32	n/a	n/a	no
DT76	Diffusion tube	31	27	n/a	n/a	no
DT88	Diffusion tube	34	34	n/a	n/a	no
DT89	Diffusion tube	34	31	n/a	n/a	no
DT64	Diffusion tube	**40**	**40**	n/a	n/a	no

As in the previous two years the only point of exceedance was DT64 (Tong Street). In 2018 site DT64 was at the objective level of 40µg/m^3, a slightly lower value than that recorded in 2017.

Figure 11 - Trends around Rook Lane / Rooley Lane /Tong Street area

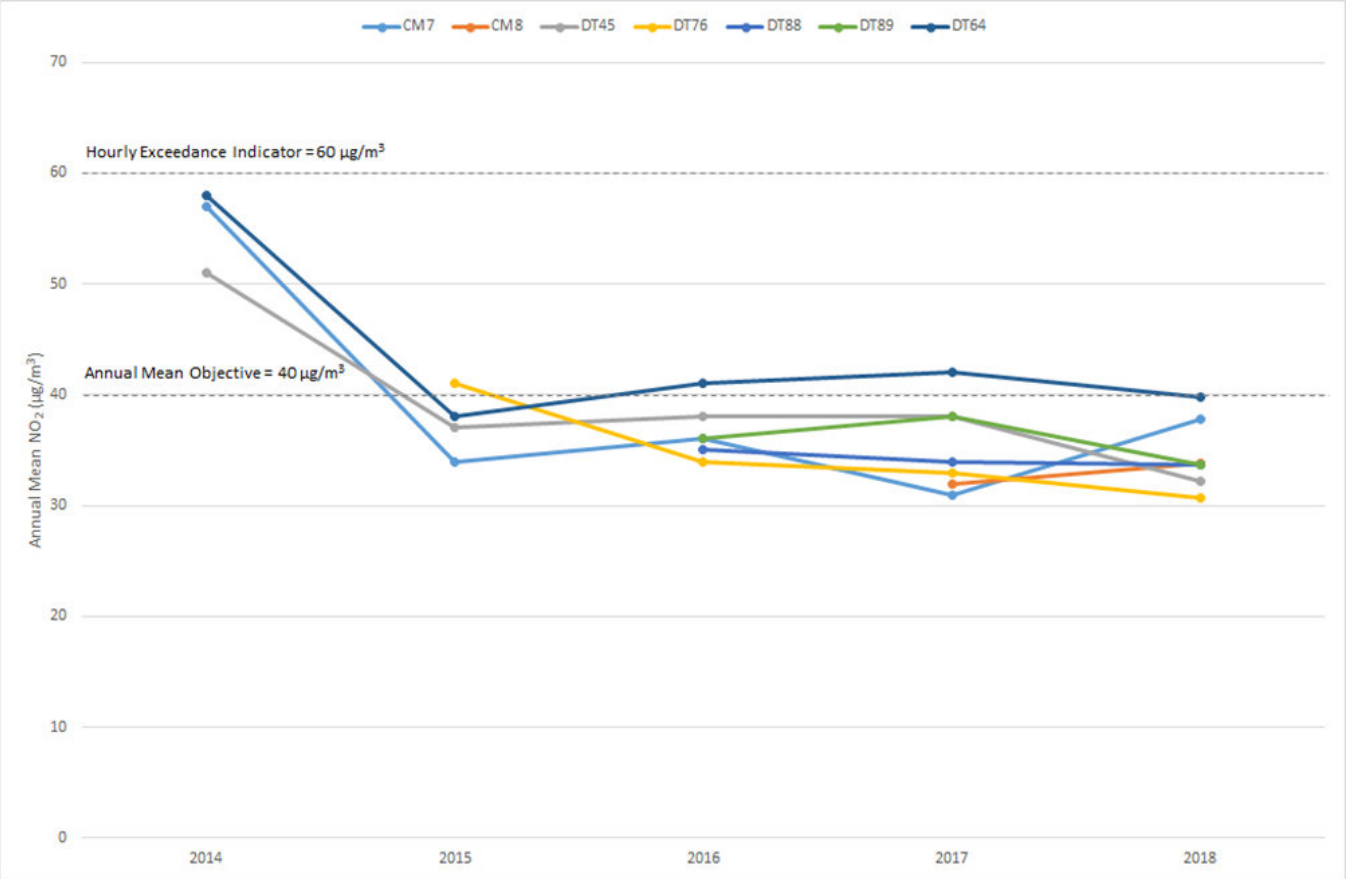


Figure 11 details the bias corrected measured values at the monitoring locations in the Rook Lane / Rooley Lane /Tong Street. NO_2 concentrations dropped significantly around 2015 at all the long term monitoring sites (although the reason for this is unclear). Since then concentrations have remained stable and in the majority of cases remain below the objective level.

Monitoring will continue in this area during 2019. The need for an AQMA declaration in this area will be reviewed again following completion of the air quality plan business case.

Current situation Harrogate Road / Killinghall Road

The 2016 ASR report identified exceedance of the annual average NO_2 in the vicinity of the Harrogate Road / Killinghall Road junction. As previously reported additional monitoring was introduced into this area in 2017 to consider the extent of this exceedance.

The distance corrected results for each of these sites during 2018 are detailed in the table below. The locations of these tubes are shown on Map 9 (Annex D).

Site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) ($\mu g/m^3$)	Maximum hourly concentration at monitoring point ($\mu g/m^3$)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60µg/m^3)?
DT5	Diffusion tube	29	29	n/a	n/a	no
DT39	Diffusion tube	35	33	n/a	n/a	no
DT42	Diffusion tube	**43**	39	n/a	n/a	no
DT86	Diffusion tube	31	31	n/a	n/a	no
DT99	Diffusion tube	25	25	n/a	n/a	no
DT100	Diffusion tube	25	25	n/a	n/a	no

Sites DT5 and DT42 have previously been reported as being at risk of breaching the annual average NO_2 objective (2017 ASR).

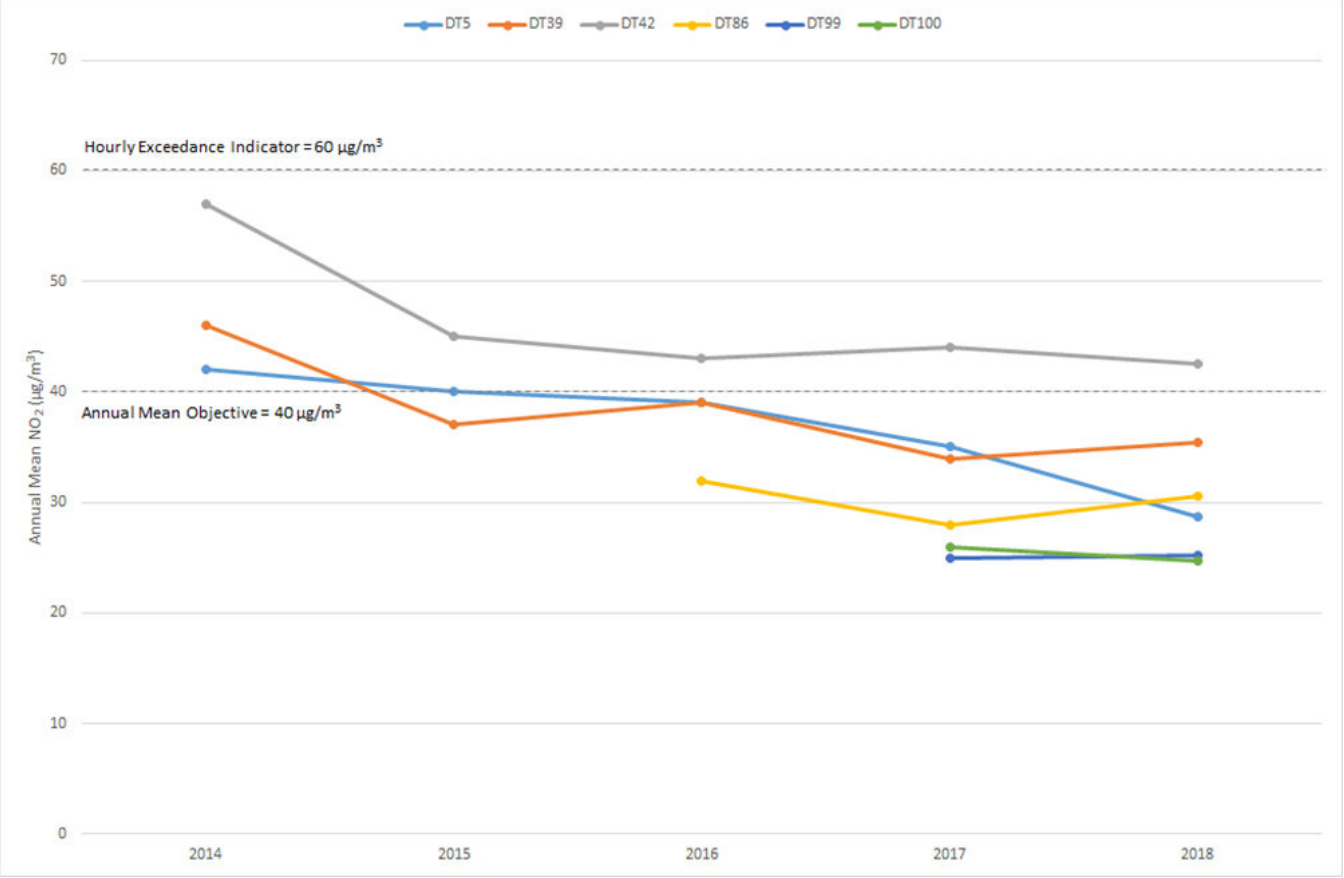
During 2018 the annual average concentration at site DT5 was 29µg/m^3 representing an improvement in air quality for the fifth consecutive year. This site is no longer considered at risk of breaching the annual average air quality objective for NO_2.

Site DT42 also showed an improvement in 2018 compared with the previous year. When corrected for distance to the nearest relevant receptor it was just below the objective level at 39µg/m^3. Site DT42 is located close to the Killinghall Road / Harrogate Road junction. The nearest relevant receptor point is an upstairs flat with only one very small window on the Killinghall Road façade. This does not appear to serve a habitable room.

The new tubes (DT99 and DT100) returned very similar values to those obtained in 2017. These results confirm that the elevated pollutant concentrations in this area are confined to the area immediately around the junction and do not extend into the more densely populated area on Harrogate Road.

Figure 12 details the trend in measured annual average NO_2 concentration around the Killinghall Road / Harrogate Road junction (at measurement position not distance corrected).

Figure 12 - Trends around Killinghall Road / Harrogate Road junction



Based on the long term trends and the concentrations measured in 2018 the declaration of a further AQMA in this area is no longer considered necessary but monitoring will be continued to ensure levels remain at or below the objective level (at relevant receptor points). An update on concentrations in this area will be provided in the 2020 ASR report.

Current situation Canal Road

The national PCM air pollution model operated on behalf of Defra has identified potential exceedance of EU limit values in the Canal Road area (as well as in other areas of the city). Monitoring was established in the Canal Road area in 2016 close to the site of a large mixed use planning application. This monitoring was extended in 2017 to include further relevant locations in the area. Monitoring at these sites continued throughout 2018.

The results of the 2018 monitoring in the Canal Road area are detailed in the table below. A map of the monitoring sites can be found in Appendix D (Map10).

Site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) ($\mu g/m^3$)	Maximum hourly concentration at monitoring point ($\mu g/m^3$)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60µg/m^3)?
DT73	Diffusion tube	**46**	**46**	n/a	n/a	no
DT74	Diffusion tube	20	20	n/a	n/a	no
DT111	Diffusion tube	37	33	n/a	n/a	no
DT112	Diffusion tube	38	27	n/a	n/a	no

During 2018 the annual average concentration of NO_2 at site DT73 exceeded 40µg/m^3 (as predicted by Defra's PCM model) but there is no relevant exposure at this location. Sites DT111 and DT112 are located closer to housing but were both below the objective level. Based on the 2018 monitoring data there is no requirement to declare an AQMA on Canal Road at present.

Monitoring will be continued along Canal Road to support development of the air quality plan business case and establish longer term trends. A further update on concentrations in this area will be provided in the 2020 ASR report.

Current situation Greengates crossroads

In the 2017 ASR report it was reported that elevated concentrations of NO_2 had been observed around the Greengates junction following the installation of monitoring to support a planning application for a major junction improvement scheme.

The junction improvement was approved in 2018 (planning reference17/00916/FUL) and following a delay works are now due to commence in February 2020.

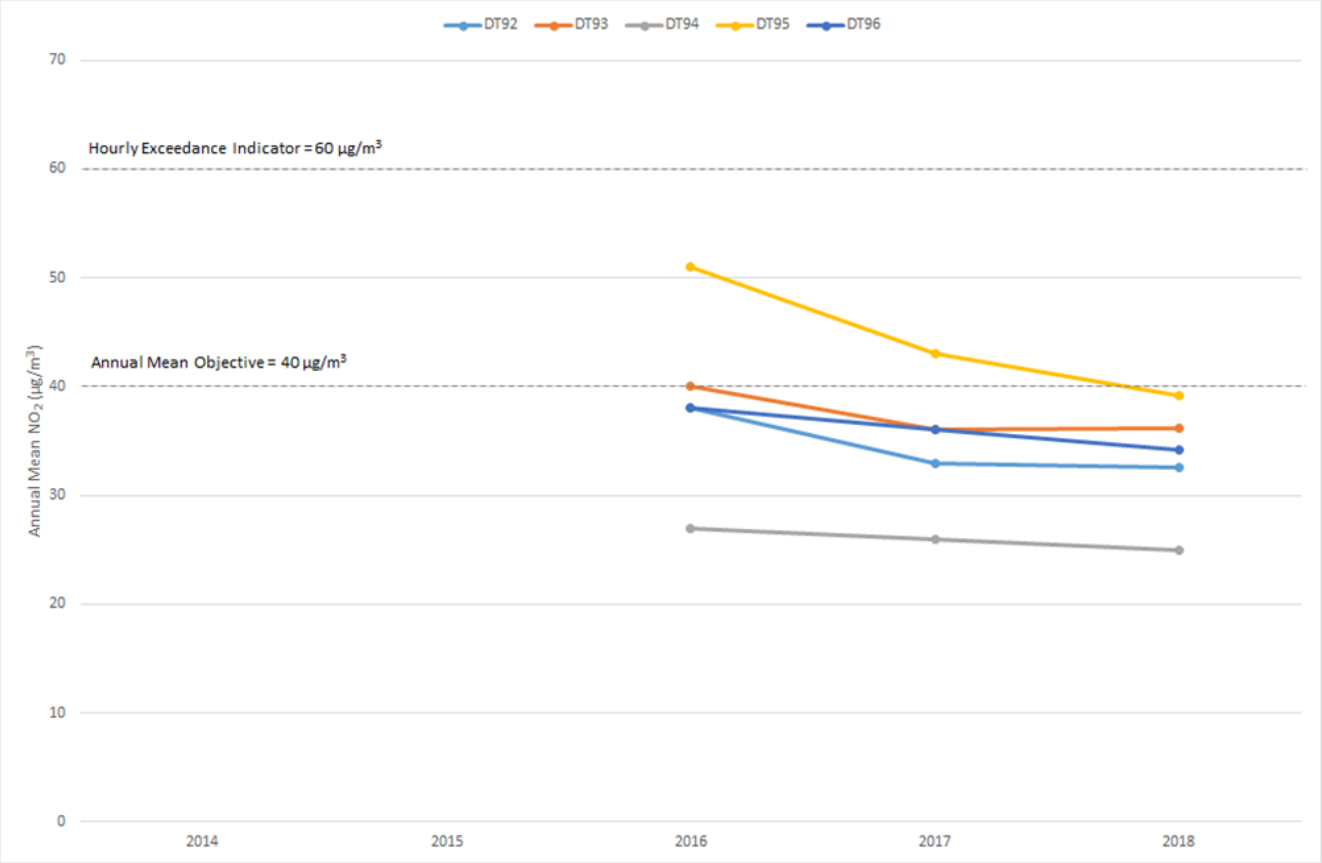
The results of the monitoring at Greengates crossroads during 2018 are shown in the table below. The monitoring site locations are shown in Appendix D (map 11).

Site	Type	Bias corrected annual average concentration at monitoring point ($\mu g/m^3$)	Bias corrected annual average concentration at nearest relevant receptor point (distance corrected) ($\mu g/m^3$)	Maximum hourly concentration at monitoring point ($\mu g/m^3$)	Number of exceedances of hourly objective at monitoring point	Does tube data suggest breaches of hourly objective (annual average>60$\mu g/m^3$)?
DT92	Diffusion tube	33	33	n/a	n/a	no
DT93	Diffusion tube	36	36	n/a	n/a	no
DT94	Diffusion tube	25	24	n/a	n/a	no
DT95	Diffusion tube	39	39	n/a	n/a	no
DT96	Diffusion tube	34	26	n/a	n/a	no

During 2018 none of the Greengates junction monitoring sites exceeded the annual average objective for NO_2. As shown in Figure 13 levels recorded in 2018 were

similar to those in 2017 with the exception of site DT95 which exhibited an improvement.

Figure 13 - Trends around Greengates crossroads



The air quality impact assessment submitted with the planning application indicates that air quality will be improved in the area as a result of the improvement works.

Monitoring work will be continued until the full impacts of the junction works can be assessed.

3.2.2 Particulate Matter (PM_{10})

Error! Reference source not found. in Appendix A compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past 5 years with the air quality objective of 40µg/m^3.

Table A.5 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past 5 years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.

Compliance with annual average objective

There were no exceedances of the annual average air quality objective for PM_{10} recorded at any of the continuous monitoring sites in Bradford during 2018.

The annual average background level of PM_{10} recorded at CM2 (Keighley) in 2018 was slightly higher than those recorded in the previous four years. Some annual variation in background concentration is, however, to be expected due to the influence of weather conditions.

Long term trend data for the roadside PM_{10} site at Shipley Airedale Road is not available due to a break in PM_{10} monitoring between 2013 and late 2015. This was to allow levels of $PM_{2.5}$ to be assessed at the same site. In 2012 the annual average PM_{10} concentration at Shipley Airedale Road was recorded as 30µg/m^3. The 2018 data indicates this has fallen considerably to 21.2µg/m^3 but this is slightly higher value than that recorded in 2017 (18.6µg/m^3).

The Tong Street analyser (CM8) has only been in positon for 2 years. During this period the annual average PM_{10} concentration has fallen from 16.3 µg/m^3 to 15.6 µg/m^3. As this is within the normal level of variation expected due to weather conditions it is currently difficult to determine the long term annual average PM_{10} trend at Tong Street.

Figure A.1 in Appendix A shows the trends in annual mean PM_{10} concentrations.

Compliance with daily mean objective

Table A.6 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the previous 5 years with the air quality objective of 50µg/m^3, which is not to be exceeded more than 35 times per year.

There were 4 exceedances of the 50µg/m^3 daily mean objective at CM2 (Keighley) during 2018.

These occurred on:

- 13/02/2018 64µg/m^3
- 04/08/2018 78µg/m^3

- 05/08/2018 66µg/m^3
- 05/11/2018 76µg/m^3

There were 4 exceedances of the 50µg/m^3 daily mean objective at CM6 (Shipley Airedale Road) during 2018.

These occurred on:

- 05/02/2018 56µg/m^3
- 05/11/2018 106µg/m^3
- 06/11/2018 65µg/m^3
- 23/11/2018 55µg/m^3

There was 1 exceedance of the 50µg/m^3 daily mean objective at CM8 (Tong Street) during 2018.

This occurred on:

- 05/11/2018 73µg/m^3

35 exceedances of the 50µg/m^3 objective are allowed at any one site per annum, therefore the 24 hour daily mean objective was complied with in Bradford during 2018.

All sites exhibited high concentrations of PM_{10} around bonfire night celebrations (5th and 6th November).

3.2.3 Particulate Matter ($PM_{2.5}$)

Table A.6 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past 5 years.

The annual average background level of $PM_{2.5}$ recorded at CM2 (Keighley) in 2018 was slightly higher than those recorded in the previous four years as was that at CM6 (Shipley Airedale Road). Some annual variation in background concentration is to be expected due to the influence of weather conditions and these increases are not considered significant.

The $PM_{2.5}$ annual average concentation measured at CM8 (Tong Street) was slightly lower in 2018 than 2017.

Figure A.5 in Appendix A shows the trends in annual mean $PM_{2.5}$ concentrations.

$PM_{2.5}$ concentrations in Bradford are well below the EU target value of 25µg/m^3 but in some locations the World Health Organisation (WHO) guideline of 10µg/m^3 is exceeded. The WHO guideline is currently exceeded in most urban centres in the UK but there is currently no statutory obligation for local authorities to meet either of these PM2.5 targets.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
CM2	Keighley	Urban Centre	406058	441273	NO2; PM10	NO	Chemiluminescent	n/a	5	2.7
CM3	Manningham Lane	Roadside	415582	434457	NO2	YES	Chemiluminescent	4	1.5	1.5
CM4	Manchester Road / Mayo Avenue	Roadside	415933	430569	NO2	YES	Chemiluminescent	2	2	1.5
CM5	Thornton Road	Roadside	415887	433047	NO2	YES	Chemiluminescent	0	2	1.5
CM6	Shipley Airedale Road	Roadside	416974	433245	NO2; PM10	YES	Chemiluminescent	2	2	2.7
CM7	Rook Lane	Roadside	417860	430705	NO2	YES	Chemiluminescent	1	1.5	1.5
CM8	Tong Street	Roadside	419188	430213	NO2; PM10	NO	Chemiluminescent	0	5.8	2.7

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 A.2 – Details of Non-Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube collocated with a Continuous Analyser?	Height (m)
DT5	Harrogate Road	Kerbside	417982	434886	NO2	NO	0	1	NO	2.5 - 2.6
DT39	Harrogate Road	Roadside	417927	434799	NO2	NO	2	2	NO	2.5 - 2.6
DT42	Killinghall	Kerbside	417902	434751	NO2	NO	1.3	1	NO	2.5-2.6
DT12	Treadwell Mills	Roadside	416967	433268	NO2	YES	1	1.5	NO	2.5 - 2.6
DT45	Rook Lane lampost 17	Roadside	417877	430717	NO2	NO	0	1.5	NO	2.5 - 2.6
DT30	29 Saltaire Road	Roadside	413861	437772	NO2	NO	2	2	NO	2.5 - 2.6
DT31	Lampost 233 80 Bradford Road	Roadside	413527	437713	NO2	NO	4	1.5	NO	2.5 - 2.6
DT49	9 Moorhead Lane	Roadside	413604	437658	NO2	NO	4	1.5	NO	2.5 - 2.6
DT50	203 Bradford Road	Roadside	413510	437732	NO2	NO	2.5	2	NO	2.5 - 2.6
DT68	Co-Located at AQ Station	Roadside	406060	441274	NO2	NO	n/a	5	YES	3
DT69	Co-Located at AQ Station	Roadside	406060	441274	NO2	NO	n/a	5	YES	3
DT70	Co-Located at AQ Station	Roadside	406060	441274	NO2	NO	n/a	5	YES	3
DT64	Tong Street	Roadside	419379	430091	NO2	NO	0	1.5	NO	2.5 - 2.6
DT21	12 Prospect Street, Keighley	Background	404719	440613	NO2	NO	0	>5	NO	2.5 - 2.6
DT71	Post 53 Manningham Lane adj ST Nox unit	Roadside	415585	434455	NO2	YES	4	1.5	NO	2.5 - 2.6

DT72	Post 2 Queens Rd (traffic lights)	Roadside	415573	434521	NO2	YES	0	2	NO	2.5 - 2.6
DT73	Post 61 Canal Rd (opp garden centre)	Kerbside	415448	435812	NO2	NO	n/a	1	NO	2.5 - 2.6
DT74	Post 4 Gaisby Ln (above cycle path)	Kerbside	415549	435918	NO2	NO	n/a	<0.5	NO	2.5 - 2.6
DT76	Post 12 junc Rook Ln/Tong St	Kerbside	418268	430732	NO2	NO	3.5	0.5	NO	2.5 - 2.6
DT78	Post 11 Aireworth Road KLY	Kerbside	407380	441811	NO2	NO	3	1	NO	2.5 - 2.6
DT79	Centenary Square	Urban Background	416282	432966	NO2	NO	0	70	NO	2.5 - 2.6
DT80	Lampost 40 City Exchange	Kerbside	416388	432817	NO2	NO	1	1	NO	2.5 - 2.6
DT81	Lampost 5 Interchange bus entrance	Kerbside	416413	432674	NO2	NO	1	1	NO	2.5 - 2.6
DT84	Wilton St- Omar Khan's	Kerbside	416054	432675	NO2	NO	5	<1	NO	2.5 - 2.6
DT86	Otley Rd lamp post no 2	Roadside	417894	434753	NO2	NO	0	2	NO	2.5 - 2.6
DT88	Tong Street lamp post no 181	Roadside	418829	430399	NO2	NO	0	2	NO	2.5 - 2.6
DT89	Tong St/Broadstone Way Car Park	Roadside	419188	430213	NO2	NO	3	3	NO	2.5 - 2.6
DT91	Dove Street / Saltaire Road	Roadside	413697	437723	NO2	NO	0	1.5	NO	2.5 - 2.6
DT92	Harrogate Rd (Greengates)	Roadside	419006	437217	NO2	NO	n/a	1.5	NO	2.5 - 2.6
DT93	New Line (former school)	Kerbside	419003	437308	NO2	NO	0	1	NO	2.5 - 2.6
DT94	Stockhill Rd (school)	Roadside	419103	437337	NO2	NO	2.5	3.5	NO	2.5 - 2.6
DT95	Harrogate Rd	Kerbside	419111	437322	NO2	NO	n/a	1	NO	2.5 - 2.6

DT96	New Line (ped crossing)	Kerbside	419152	437209	NO2	NO	7	1	NO	2.5 - 2.6
DT99	Charnwood Grove/Harrogate Rd LP below junc	Roadside	418033	434970	NO2	NO	0	7.5	NO	2.5 - 2.6
DT100	Killinghall Rd opp car park LP former soc ser	Roadside	417949	434693	NO2	NO	0	2.4	NO	2.5 - 2.6
DT101	Bingley Rd Saltaire LP 37 nearest shops	Roadside	413418	437725	NO2	NO	8	1.4	NO	2.5 - 2.6
DT102	Bingley Rd Saltaire LP nr house 43	Roadside	413338	437720	NO2	NO	7.7	2.4	NO	2.5 - 2.6
DT103	Mayo Ave first LP left of AQMS	Roadside	415925	430572	NO2	YES	4.9	3.6	NO	2.5 - 2.6
DT104	Mayo Ave first LP right of AQMS	Roadside	415961	430558	NO2	YES	4.9	4.4	NO	2.5 - 2.6
DT105	Manchester Rd LP nearest house 793	Roadside	415780	430504	NO2	YES	0	6.8	NO	2.5 - 2.6
DT106	Smiddles Lane LP nearest fence to Bankfoot School	Roadside	415702	430702	NO2	YES	2.4	4	NO	2.5 - 2.6
DT107	Broadway Ave off Manch Rd adj City bathrooms	Roadside	415833	430837	NO2	NO	0	5.2	NO	2.5 - 2.6
DT108	Thornton Rd LP 24 after Street Nox	Roadside	415858	433061	NO2	YES	0.6	4.5	NO	2.5 - 2.6
DT109	Thornton Rd LP below Street Nox	Roadside	415891	433045	NO2	YES	0.5	3	NO	2.5 - 2.6
DT110	Thornton Rd Lp adj to student accom	Roadside	415806	433061	NO2	NO	1.7	4.4	NO	2.5 - 2.6
DT111	Canal Rd/ Midland Terr LP nr post box	Roadside	416015	435028	NO2	NO	3.5	3.1	NO	2.5 - 2.6
DT112	Canal Rd LP nearest flats by car wash	Kerbside	415024	436743	NO2	NO	9.16	0.7	NO	2.5 - 2.6

DT113	Young Street lp1	Roadside	414014	433357	NO2	NO	0	2.6	NO	2.5 - 2.6
DT114	Young Street fence adj to lp 2	Roadside	414009	433405	NO2	NO	0	2.8	NO	2.5 - 2.6
DT115	Buller Street lp4	Urban Background	418421	432214	NO2	NO	0	n/a	NO	2.5 - 2.6
DT116	Sticker Lane lp41	Roadside	418564	432218	NO2	NO	0	3	NO	2.5 - 2.6
DT117	Parry lane lp4	Kerbside	418192	432208	NO2	NO	0	0.7	NO	2.5 - 2.6
DT118	Fearnville Drive lp1	Roadside	418666	432470	NO2	NO	4	4.1	NO	2.5 - 2.6
DT119	Laisterdyke LP5 adj NO9	Roadside	418626	432945	NO2	NO	0.5	2.4	NO	2.5 - 2.6
DT120	Leeds Rd St Marys School	Roadside	417991	432926	NO2	NO	0	4	NO	2.5 - 2.6

Notes:

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

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2018 (%) [2]	NO_2 Annual Mean Concentration ($\mu g/m^3$) [3]				
					2014	2015	2016	2017	2018
CM2	Urban Centre	Automatic	87.0	87.0	27	28	31	24	27
CM3	Roadside	Automatic	65.9	40.2	35	**42**	**41**	39	**51**
CM4	Roadside	Automatic	97.3	97.3	**42**	**42**	**46**	**42**	**44**
CM5	Roadside	Automatic	95.1	95.1	**51**	33	31	30	**45**
CM6	Roadside	Automatic	87.9	87.9	**54**	**48**	**52**	**40**	**48**
CM7	Roadside	Automatic	97.1	97.1	**57**	34	36	31	38
CM8	Roadside	Automatic	97.2	97.2	no data	no data	no data	32	34
DT5	Kerbside	Diffusion Tube	91.7	91.7	**42**	**40**	39	35	29
DT39	Roadside	Diffusion Tube	100.0	100.0	**46**	37	39	34	35
DT42	Kerbside	Diffusion Tube	100.0	100.0	**57**	**45**	**43**	**44**	**43**
DT12	Roadside	Diffusion Tube	100.0	100.0	**84**	**66**	**69**	**62**	**55**
DT45	Roadside	Diffusion Tube	91.7	91.7	**51**	37	38	38	32
DT30	Roadside	Diffusion Tube	100.0	100.0	**49**	39	**41**	37	**40**
DT31	Roadside	Diffusion Tube	100.0	100.0	**42**	**49**	**50**	**49**	**51**
DT49	Roadside	Diffusion Tube	100.0	100.0	**46**	33	35	31	33
DT50	Roadside	Diffusion Tube	100.0	100.0	**57**	**56**	**60**	**63**	**58**
DT68	Roadside	Diffusion Tube	100.0	100.0	34	30	30	25	28
DT69	Roadside	Diffusion Tube	100.0	100.0	35	30	31	28	28
DT70	Roadside	Diffusion Tube	100.0	100.0	39	31	32	27	28

DT64	Roadside	Diffusion Tube	100.0	100.0	**58**	38	**41**	**42**	**40**
DT21	Background	Diffusion Tube	91.7	91.7	21	17	12	12	11
DT71	Roadside	Diffusion Tube	91.7	91.7	**no data**	**40**	**39**	**43**	**40**
DT72	Roadside	Diffusion Tube	100.0	100.0	**no data**	**60**	**66**	**53**	**66**
DT73	Kerbside	Diffusion Tube	91.7	91.7	no data	**51**	**51**	**46**	**46**
DT74	Kerbside	Diffusion Tube	91.7	91.7	no data	25	22	23	20
DT76	Kerbside	Diffusion Tube	100.0	100.0	no data	**41**	34	33	31
DT78	Kerbside	Diffusion Tube	100.0	100.0	no data	27	23	23	20
DT79	Urban Background	Diffusion Tube	83.3	83.3	no data	33	29	33	32
DT80	Kerbside	Diffusion Tube	91.7	91.7	no data	34	33	33	36
DT81	Kerbside	Diffusion Tube	83.3	83.3	no data	36	34	37	35
DT84	Kerbside	Diffusion Tube	100.0	100.0	no data	32	32	32	33
DT86	Roadside	Diffusion Tube	100.0	100.0	no data	no data	32	28	31
DT88	Roadside	Diffusion Tube	100.0	100.0	no data	no data	35	34	34
DT89	Roadside	Diffusion Tube	100.0	100.0	no data	no data	36	38	34
DT91	Roadside	Diffusion Tube	100.0	100.0	no data	no data	35	**40**	38
DT92	Roadside	Diffusion Tube	100.0	100.0	no data	no data	38	33	33
DT93	Kerbside	Diffusion Tube	100.0	100.0	no data	no data	**40**	36	36
DT94	Roadside	Diffusion Tube	91.7	91.7	no data	no data	27	26	25
DT95	Kerbside	Diffusion Tube	91.7	91.7	no data	no data	**51**	**43**	39
DT96	Kerbside	Diffusion Tube	100.0	100.0	no data	no data	38	36	34
DT99	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	25	25
DT100	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	26	25
DT101	Roadside	Diffusion Tube	91.7	91.7	no data	no data	no data	**44**	**42**
DT102	Roadside	Diffusion Tube	91.7	91.7	no data	no data	no data	36	**46**

DT103	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	**40**	**42**
DT104	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	**43**	**51**
DT105	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	37	**43**
DT106	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	27	30
DT107	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	23	24
DT108	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	34	33
DT109	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	35	34
DT110	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	28	32
DT111	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	39	37
DT112	Kerbside	Diffusion Tube	100.0	100.0	no data	no data	no data	31	38
DT113	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	24	22
DT114	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	21	20
DT115	Urban Background	Diffusion Tube	100.0	100.0	no data	no data	no data	23	24
DT116	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	28	27
DT117	Kerbside	Diffusion Tube	100.0	100.0	no data	no data	no data	no data	26
DT118	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	31	27
DT119	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	34	35
DT120	Roadside	Diffusion Tube	100.0	100.0	no data	no data	no data	no data	35

Diffusion tube data has been bias corrected

Annualisation has been conducted where data capture is <75%

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

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.**

(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%).

(3) Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.2 – Trends in Annual Mean NO_2 Concentrations (real time sites only)

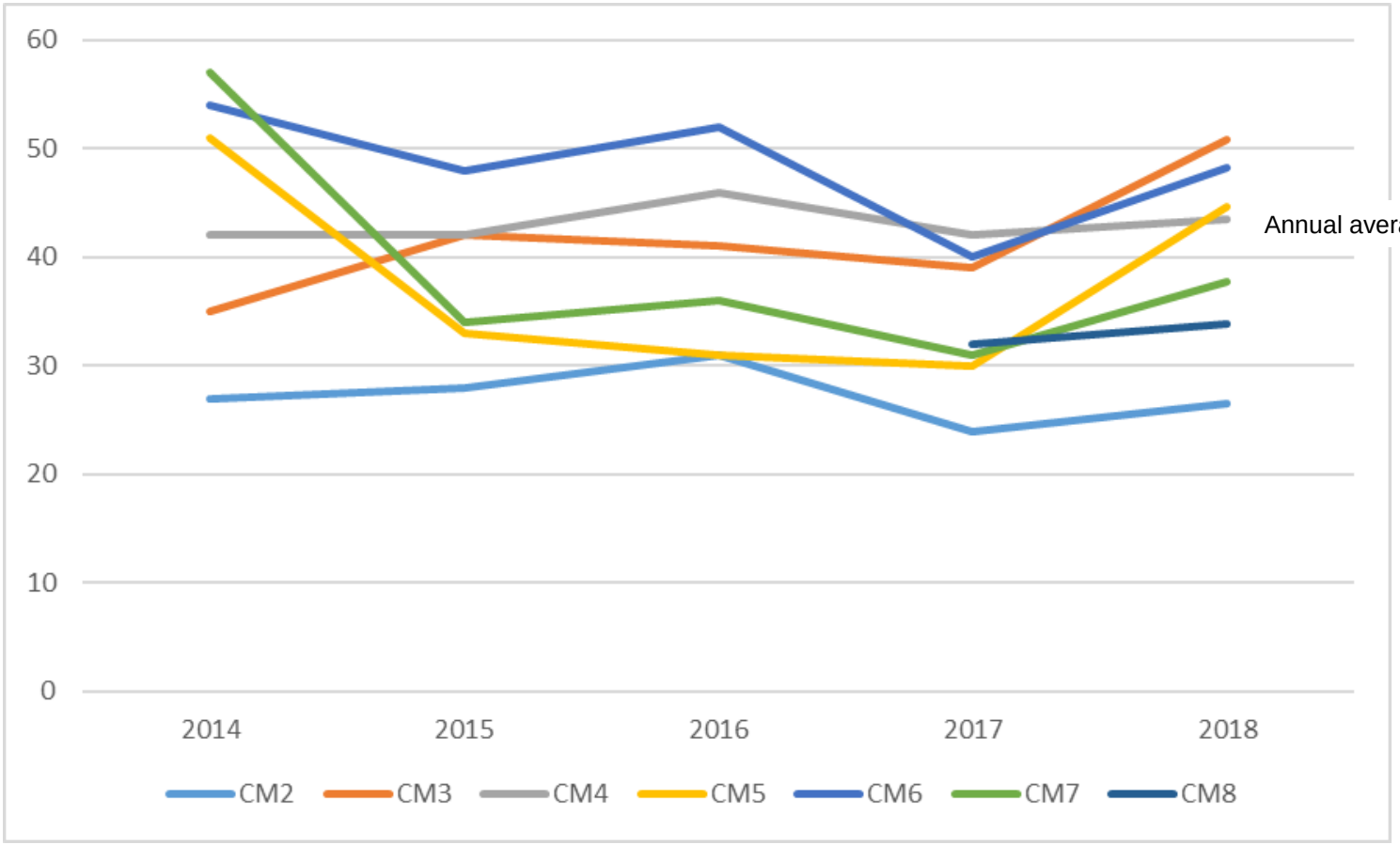


Table A.4 – 1-Hour Mean NO_2 Monitoring Results

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	NO_2 1-Hour Means > 200µg/m^3 (3)				
					2014	2015	2016	2017	2018
CM2	Urban Centre	Automatic	87.0	87.0	0	0	0	4	0
CM3	Roadside	Automatic	65.9	40.2	0 (116)	0	0 (114.3)	0 (100.0)	0 (133.9)
CM4	Roadside	Automatic	97.3	97.3	**34**	0	2	0	0
CM5	Roadside	Automatic	95.1	95.1	**141 (306)**	0	0	0	0
CM6	Roadside	Automatic	87.9	87.9	0 (135)	0	0	0 (138.0)	0
CM7	Roadside	Automatic	97.1	97.1	**106 (293)**	0	0	0	0
CM8	Roadside	Automatic	97.2	97.2	no data	no data	no data	0	0

Notes:

Exceedances of the NO_2 1-hour mean objective (200µg/m^3 not to be exceeded more than 18 times/year) are shown in **bold.**

(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%).

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

Table A.5 – Annual Mean PM10 Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} Annual Mean Concentration ($\mu g/m^3$) (3)				
				2014	2015	2016	2017	2018
CM2	Urban Centre	84.0	84.0	12.4	14	15.5	14.2	16.5
CM6	Roadside	86.6	86.6	n/a	n/a	21.2	18.6	21.2
CM8	Roadside	93.2	93.2	n/a	n/a	n/a	16.3	15.6

Annualisation has been conducted where data capture is <75

Notes:

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

(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%).

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.2 – Trends in Annual Mean PM_{10} Concentrations

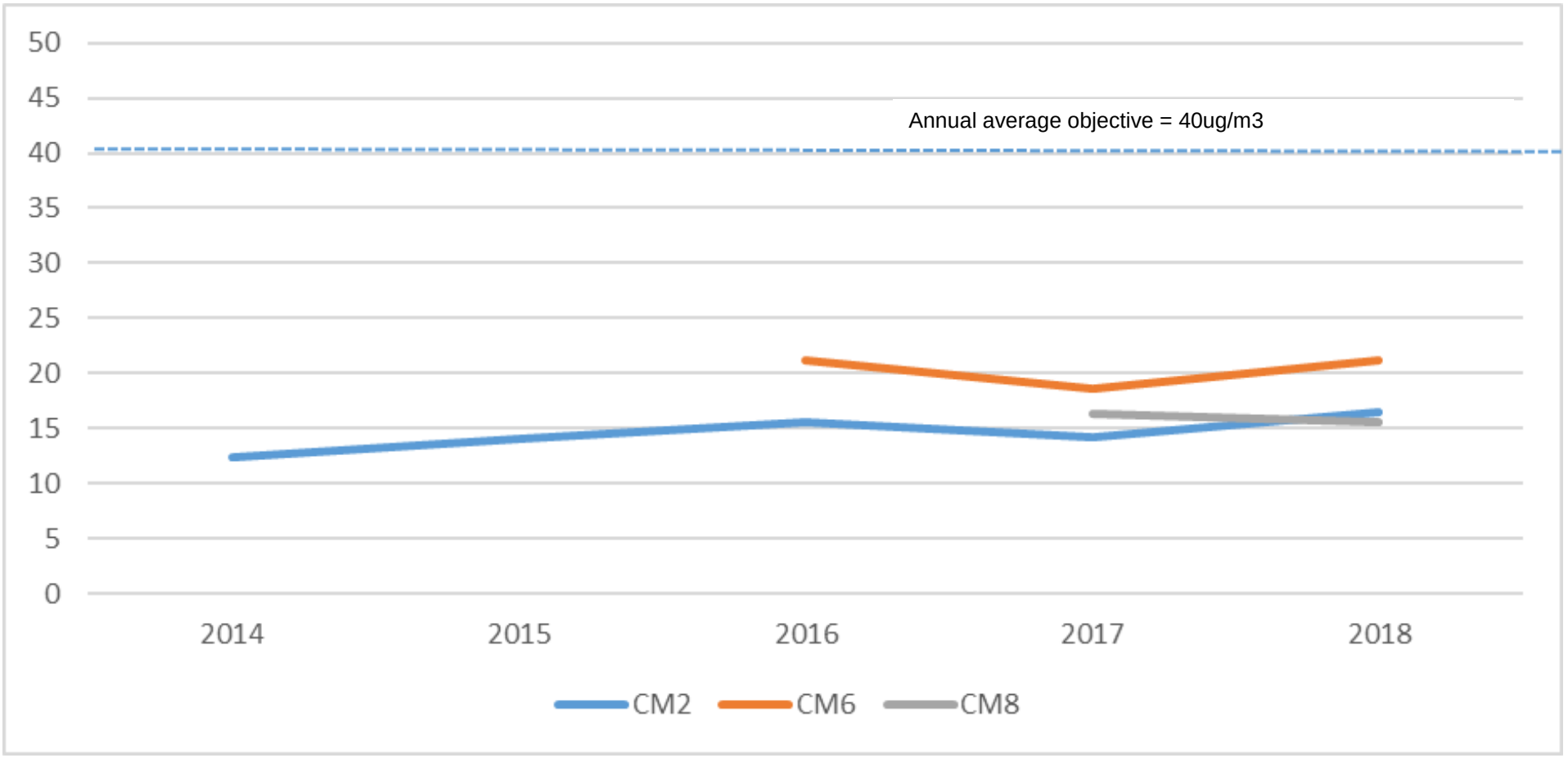


Table A.5 – 24-Hour Mean PM_{10} Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	PM_{10} 24-Hour Means > 50µg/m^3 (3)				
				2014	2015	2016	2017	2018
CM2	Urban Centre	84.0	84.0	3 (23.3)	1	1	2	4
CM6	Roadside	86.6	86.6	n/a	2	8	5	4
CM8	Roadside	93.2	93.2	n/a	n/a	n/a	4	1

Notes:

Exceedances of the PM_{10} 24-hour mean objective (50µg/m^3 not to be exceeded more than 35 times/year) are shown in **bold.**

(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%).

(3) If the period of valid data is less than 85%, the 90.4th percentile of 24-hour means is provided in brackets.

Table A.6 – $PM_{2.5}$ Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2018 (%) (2)	$PM_{2.5}$ Annual Mean Concentration ($\mu g/m^3$) (3)				
				2014	2015	2016	2017	2018
CM2	Urban Centre	81.2	81.2	n/a	9.5	9.3	8.9	10.6
CM6	Roadside	86.1	86.1	11	13.1	13	12.2	13.5
CM8	Roadside	91.8	91.8	n/a	n/a	n/a	10.4	10.2

Annualisation has been conducted where data capture is <75%

Notes:

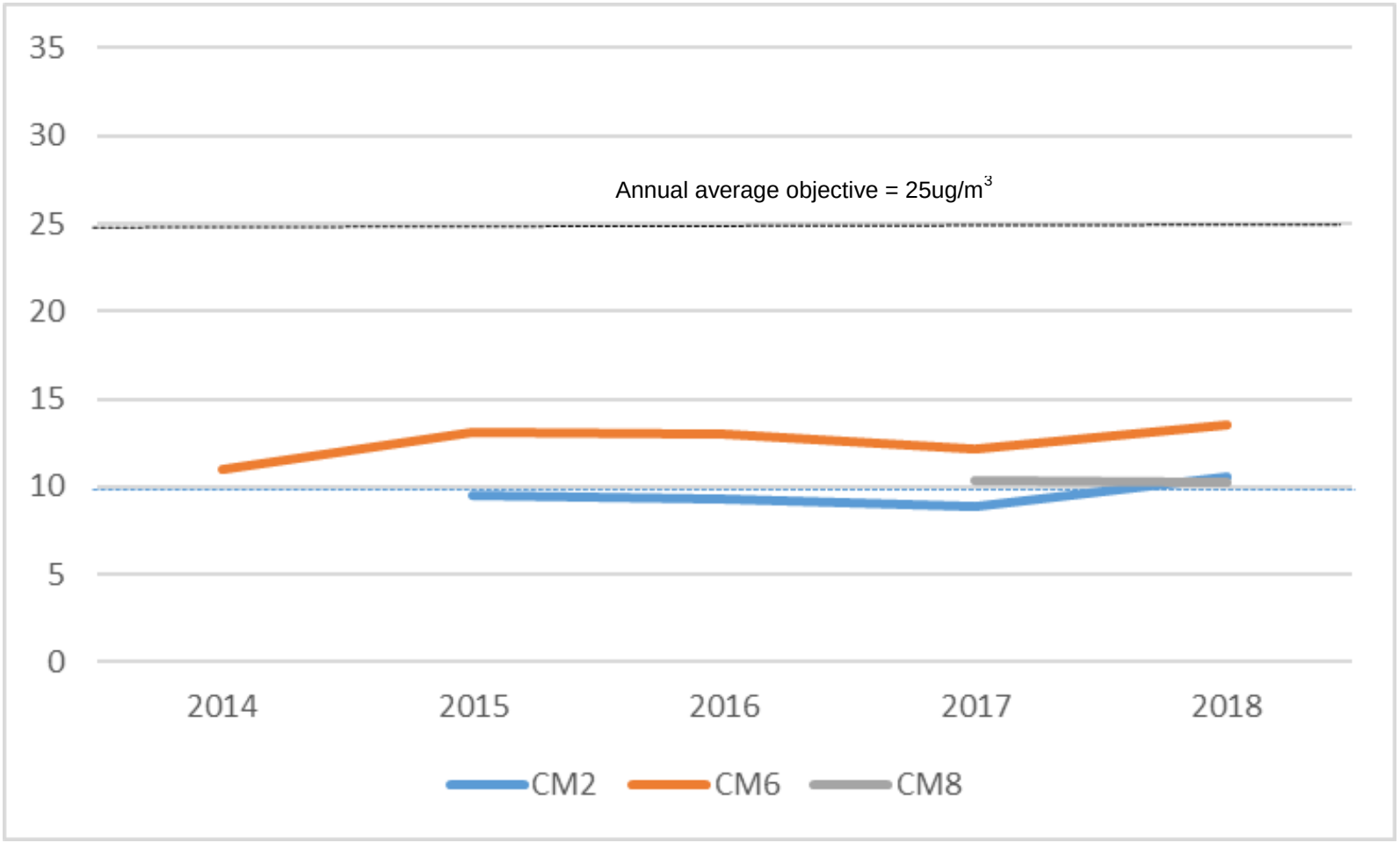
(1) Data capture for the monitoring period, in cases where monitoring was only carried out for part of the year.

(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%).

(3) All means have been "annualised" as per Boxes 7.9 and 7.10 in LAQM.TG16, valid data capture for the full calendar year is less than 75%. See Appendix C for details.

Figure A.3 – Trends in Annual Mean $PM_{2.5}$ Concentrations

WHO guideline level = 10µg/m^3



Appendix B: Full Monthly Diffusion Tube Results for 2018

Table B.1 – NO_2 Monthly Diffusion Tube Results - 2018

Site ID	NO_2 Mean Concentrations (µg/m^3)														
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean		
													Raw Data	Bias Adjusted (0.8) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
DT5	46	40	24	32	36	35	20	21	41	45	no data	55	36	29	29
DT39	51	53	51	37	37	39	30	29	41	46	60	57	44	35	33
DT42	66	54	61	57	52	47	34	42	54	45	63	64	53	**43**	39
DT86	39	45	47	36	29	33	30	31	35	41	52	41	38	31	31
DT99	44	37	42	28	20	19	13	23	29	36	41	47	32	25	25
DT100	31	40	39	27	21	18	20	27	30	37	46	34	31	25	25
DT45	51	49	49	39	29	28	27	42	34	44	51	no data	40	32	32
DT76	32	43	49	37	35	26	22	26	33	48	63	46	38	31	27
DT64	58	56	57	48	52	35	37	45	43	52	55	59	50	**40**	**40**
DT88	48	51	51	40	39	29	32	32	35	42	50	56	42	34	34
DT89	55	51	43	43	33	26	34	36	44	42	46	53	42	34	31
DT30	52	62	64	50	43	46	34	34	39	50	62	63	50	**40**	36
DT31	93	72	66	64	76	42	62	54	60	57	58	67	64	**51**	**41**
DT49	41	53	47	46	34	33	38	33	33	38	53	49	42	33	28

DT50	83	87	89	86	35	75	72	62	67	61	80	80	73	**58**	**50**
DT91	62	59	55	48	37	29	38	39	42	46	53	60	47	38	38
DT101	75	62	no data	59	44	48	44	36	45	53	54	60	53	**42**	31
DT102	64	no data	55	50	53	36	58	42	51	65	76	77	57	**46**	35
DT108	42	51	58	48	26	27	32	34	35	40	47	55	41	33	33
DT109	62	61	45	47	36	34	25	37	38	50	52	28	43	34	34
DT110	46	56	49	38	28	25	32	26	39	39	56	49	40	32	31
DT103	54	65	71	66	54	49	34	43	40	34	77	38	52	**42**	36
DT104	86	70	79	79	74	47	47	41	49	57	79	63	64	**51**	**44**
DT105	66	71	75	59	63	46	18	39	40	48	77	45	54	**43**	**43**
DT106	45	50	47	40	27	22	25	28	27	40	57	38	37	30	28
DT107	32	41	27	28	27	19	20	16	23	37	52	41	30	24	24
DT71	54	55	57	52	49	49	41	no data	43	43	54	58	50	**40**	34
DT72	81	109	92	87	95	71	79	72	61	74	101	74	83	**66**	**66**
DT73	62	no data	75	70	53	35	46	42	47	59	70	70	57	**46**	**46**
DT74	31	31	30	24	13	13	16	19	24	32	40	no data	25	20	20
DT111	58	57	59	54	39	32	36	38	35	44	55	55	47	37	33
DT112	59	61	53	47	58	21	32	33	37	50	63	57	48	38	27
DT92	46	51	37	38	43	31	32	31	32	44	54	49	41	33	33
DT93	52	57	42	50	56	42	19	24	40	47	58	56	45	36	36
DT94	44	43	36	23	25	18	16	25	29	no data	47	38	31	25	24
DT95	no data	55	58	43	52	47	40	36	32	50	66	59	49	39	39
DT96	47	49	50	37	43	35	33	34	47	44	44	49	43	34	26
DT68	37	33	37	36	23	21	21	28	34	42	54	56	35	28	28

DT69	32	38	32	33	26	23	25	32	35	39	53	48	35	28	28
DT70	29	41	39	35	27	23	27	29	29	42	43	53	35	28	28
DT115	47	37	32	27	20	15	17	23	25	32	36	43	30	24	24
DT116	31	48	39	32	31	20	20	27	30	42	53	34	34	27	27
DT117	47	40	35	32	20	18	19	27	33	39	42	45	33	26	26
DT118	29	45	42	42	33	23	29	26	38	34	38	22	33	27	26
DT119	59	60	58	45	39	36	35	32	32	28	48	54	44	35	34
DT12	90	83	79	41	31	72	43	75	77	73	78	79	68	**55**	**51**
DT21	21	22	19	13	9	5	7	10	no data	16	18	17	14	11	11
DT78	34	34	32	24	16	13	11	18	25	25	39	22	24	20	18
DT79	no data	97	38	35	26	no data	27	24	28	33	44	50	40	32	32
DT80	48	58	53	43	40	29	34	no data	35	45	58	52	45	36	34
DT81	47	64	51	45	46	32	no data	no data	35	36	52	35	44	35	34
DT84	29	56	55	43	43	27	26	29	34	44	55	50	41	33	29
DT113	34	36	37	30	18	15	17	22	23	29	36	32	27	22	22
DT114	32	30	36	29	21	14	14	21	22	30	32	17	25	20	20
DT120	46	57	39	45	34	31	34	39	49	46	50	57	44	35	35

National bias adjustment factor used (0.8)

Annualisation has been conducted where data capture is <75%

Where applicable, data has been distance corrected for relevant exposure

Notes:

Exceedances of the NO_2 annual mean objective of 40µg/m^3 are shown in **bold**.

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.**

(1) See Appendix C for details on bias adjustment and annualisation.

(2) Distance corrected to nearest relevant public exposure.

Appendix C: Supporting Technical Information / Air Quality Monitoring Data QA/QC

C 1.0 Diffusion tube preparation

All diffusion tubes used in conjunction with this report were prepared by West Yorkshire Analytical services using 50% TEA in acetone.

WYAS participate in the Inter-laboratory comparison scheme AIR PT. This is an independent analytical proficiency-testing (PT) scheme, operated by LGC Standards and supported by the Health and Safety Laboratory (HSL). AIR PT is a new scheme, started in April 2014, which combines two long running PT schemes: LGC Standards STACKS PT scheme and HSL WASP PT scheme. AIR PT offers a number of test samples designed to test the proficiency of laboratories undertaking analysis of chemical pollutants in ambient indoor, stack and workplace air. One such sample is the AIR NO_2 test sample type that is distributed to participants in a quarterly basis. The results of this scheme are published annually.

The AIR PT NO2 diffusion tube results for WYAS for the period covered by this progress report are shown in Table C.1

Table C.1 AIR PT NO2 diffusion tube results for WYAS (2018)

AIR round	Result for WYAS
January – February 2018	50%
April – May 2018	75%
July – August 2018	100%
September– October 2018	100%

The average WASP result for the 2018 period was 81.25%.

C 2.0 Nitrogen Dioxide Bias Factors

Local NO_2 diffusion tube bias factors are not available from the Bradford district monitoring network. The NO_2 tube results reported within this report have been corrected for bias using the 2018 factors provided on the LAQM support website

(DEFRA spreadsheet version 09/19). These factors are derived from co-location studies in other areas using WYAS tubes.

The bias factor used in this report was **0.80**

C 3.0 PM Monitoring Adjustment

The PM_{10} and $PM_{2.5}$ data within this report was collected using PM_{10}/ $PM_{2.5}$ FDMS measurement systems. It has been subject to ratification and verification checks, but has not been corrected for volatility as this is not necessary for FDMS measurements.

C 4.0 QA/QC of Automatic Monitoring

The City of Bradford Metropolitan District Council's air quality analysers are type approved as recommended in LAQM.TG1 (00) *Review and Assessment: Monitoring air quality* and LAQM.TG4 (00) *Review and assessment: Pollutant specific guidance.*

The Council's own automatic network is operated by council officers trained by the instrument supplier. Signal Group provide routine maintenance and emergency repair services. All the real time data provided in this report is from council operated analysers with the exception of the Mayo Avenue site (CM4) which is affiliated to the AURN network and operated by DEFRA.

Bradford MDC air quality staff provide local site operator duties at the Mayo Avenue monitoring station on behalf of DEFRA. Annual auditing of this site and data management is managed by DEFRA using their own contractors.

Data ratification of all the other Bradford sites for 2018 was provided under contract by Air Quality Data Management http://aqdm.co.uk/Geoff%20Broughton.html

The City of Bradford MDC monitoring sites have a programme of routine operational checks and programmed fortnightly site visits which include:

- Daily checks on data transfer, telephone lines and analyser operation
- Carrying out of repairs under a service agreement with the equipment supplier (Signal Group).
- Fortnightly manual calibration checks, site inspections of equipment status, site safety and security (by Bradford MDC staff).

- Programmed six-monthly servicing and calibration by equipment suppliers under service agreement (Signal Group)

Maintenance systems

The Council's monitoring network of automatic continuous monitors is maintained in accordance with a schedule which is essentially similar to that employed for the AURN and affiliated sites. All analysers are maintained and serviced according to manufacturer's specifications and have a six-monthly service and recalibration by Signal Ambitech, the suppliers of the equipment. The servicing, calibration, and repair documentation is kept in a central record. Routine maintenance is carried out at the two-weekly calibration site visit, and any faults are recorded with the calibration log for the visit. These records are kept on site and centrally at the Environmental Health Services Scientific and Technical Services Team office.

Calibration Routines

A zero and span calibration check is performed during the site inspection visit. The methodology used is essentially that found in the AURN Local Site Operators Manual issued by NETCEN, and the manufacturer's instruction manual.

The basic steps are:

- Pre-calibration check of the general site condition and status of the analyser, before the zero and span checks are performed.
- Zero check to verify the performance of the analyser in the absence of the gas being monitored.
- Span check to verify the response of the analyser to gas of a known concentration.
- Post calibration check of the general site condition and status of the analyser on completion of all calibration routines.

A record of each analyser zero and span check is fully documented and a record kept on site and also centrally.

Calibration Gas Standards

The gases used for onsite span calibration checks at the Bradford owned air pollution stations are supplied by Air Liquide Ltd. Calibration gases for the Mayo Avenue site

operated by DEFRA are supplied by BOC Ltd. Calibration gases are traceable via European Accreditation DIN EN 45001 and DIN EN ISO 900. The tolerance of the nitrogen dioxide and nitric oxide in air mixes is typically ±5%, and for a sulphur dioxide in air mix, it is typically ±5%. Zero air is generated internally in the Ambirak, and the scrubbers are changed when necessary in accordance with manufacturer's recommendations and the NETCEN LSO Site Manual for the Ambirak.

Data scaling, validation and ratification

Unscaled data is gathered every hour by an Ambidesk system located in the Scientific and Technical Services Team office. Scaling factors are applied automatically by the Ambidesk software using factors derived during the fortnightly calibration check and the daily automatic internal calibration checks at the Ambirak.

A daily report is generated to enable unusual readings to be identified. Monthly reports are produced for further checks on data capture rates, and any other unusual variations in measured scaled data. The original raw unscaled data is retained on disk at the Ambirak in the event of anomalous scaled data events.

All scaled hourly results for 2018 downloaded from the Ambirak system have been independently ratified by Air Quality Data Management prior to use in this report. http://aqdm.co.uk/Geoff%20Broughton.html

Short-term to Long-term Data Adjustment

No short to long term data adjustment was required for the diffusion tube data for the purpose of this report.

No short to long term data adjustment was required for the PM_{10} or $PM_{2.5}$ data used in this report.

The only NO_2 real time site requiring short to long term data adjustment was Manningham Lane (CM3) which had an annual data capture of 40.2%.

Annualisation of Manningham Lane (Site CM3)

This has been done in accordance with Box 7.9 in LAQM.TG16.

In line with the guidance, both sites chosen are urban background sites and within 50 miles of Manningham Lane, Bradford.

Background Site	Data Capture (%)	Annual Mean 2018 (Am)	Period Mean 2018 (Pm)	Ratio (Am / Pm)
Leeds Centre (Urban Background)	98.4	29.7	31.2	0.95
Barnsley Gawber (Urban Background)	99.0	15.6	16.6	0.94
			Average ratio:	0.95

Manningham Lane annual mean NO_2 was 53.5µg/m^3 (40.2% data capture)

Annualised annual mean for Manningham Lane = 53.5 x 0.95 = 50.8µg/m^3

Estimate of 2018 annual mean = **50.8µg/m^3**

Distance correction calculations

Distance correction has been carried out in line with paragraphs 7.77 – 7.79 of LAQM.TG (16). Local annual mean background NO_2 concentrations for individual tubes have been taken from DEFRA background maps and used in the fall-off with distance calculator.

https://laqm.defra.gov.uk/tools-monitoring-data/no2-falloff.html

Table C.2 below provides commentary on each of these tubes and shows the information used to distance correct the diffusion tube data. Where a distance correction has not been undertaken, commentary has been provided in the table to explain the reason for this decision. In some instances, diffusion tubes are not strictly in relevant locations but are located at the same distance from the road as nearby properties that would be considered relevant locations. In such instances, tubes are reported as being in relevant locations. All tubes shown in the table are already contained within the Air Quality Management Area boundary (with the exception of tube D51 which is not located at a relevant location for the purposes of LAQM).

Table C.2 – Diffusion tube distance corrections

Site Name / ID	Distance (m)		NO_2 Annual Mean Concentration ($\mu g/m^3$)			Comment
	Monitoring Site to Kerb	Receptor to Kerb	Background	Monitored at Site	Predicted at Receptor	
DT39	2.0	4.0	18.4	35.4	32.6	
DT42	1.0	2.3	18.4	42.6	*38.5*	Predicted concentration at Receptor within 10% the AQS objective.
DT12	1.5	2.5	22.3	54.7	**51.1**	Predicted concentration at Receptor above AQS objective.
DT30	2.0	4.0	14.8	39.9	35.9	
DT31	1.5	5.5	14.8	51.4	**41.0**	Predicted concentration at Receptor above AQS objective.
DT49	1.5	5.5	14.8	33.2	28.0	
DT50	2.0	4.5	14.8	58.5	**50.2**	Predicted concentration at Receptor above AQS objective.
DT71	1.5	5.5	17.9	40.4	34.0	
DT76	0.5	4.0	20.1	30.7	26.8	
DT78	1.0	4.0	13.1	19.5	17.7	
DT80	1.0	2.0	23.2	36.0	34.2	
DT81	1.0	2.0	23.2	35.4	33.7	
DT84	1.0	6.0	23.2	32.7	29.3	
DT89	3.0	6.0	16.9	33.7	30.7	

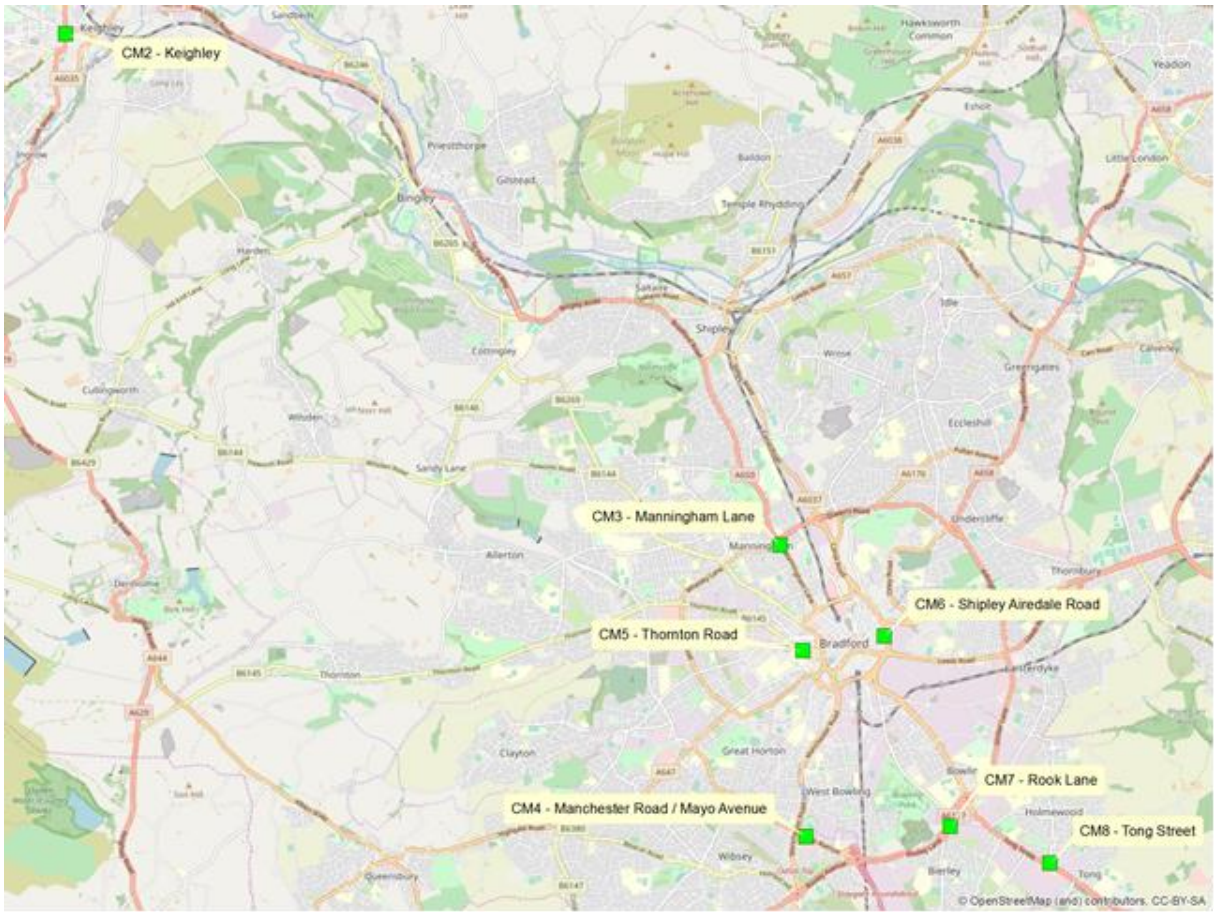
DT94	3.5	6.0	15.6	25.0	23.6	
DT96	1.0	8.0	15.6	34.1	26.4	
DT101	1.4	9.4	14.8	42.2	30.9	
DT102	2.4	10.1	14.8	45.6	34.8	
DT103	3.6	8.5	18.1	41.7	*36.2*	Predicted concentration at Receptor within 10% the AQS objective.
DT104	4.4	9.3	18.1	51.4	**44.2**	Predicted concentration at Receptor above AQS objective.
DT106	4.0	6.4	18.1	29.7	28.2	
DT108	4.5	5.1	20.5	33.0	32.5	

DT109	3.0	3.5	20.5	34.3	33.8	
DT110	4.4	6.1	20.5	32.2	31.1	
DT111	3.1	6.6	15.3	37.5	33.1	
DT112	0.7	9.9	14.9	38.1	26.5	
DT118	4.1	8.1	20.1	26.7	25.5	
DT119	2.4	2.9	20.1	35.1	34.4	
CM3	1.5	5.5	17.9	50.8	**41.4**	Predicted concentration at Receptor above AQS objective.
CM4	2.0	4.0	18.1	43.5	*39.4*	Predicted concentration at Receptor within 10% the AQS objective.

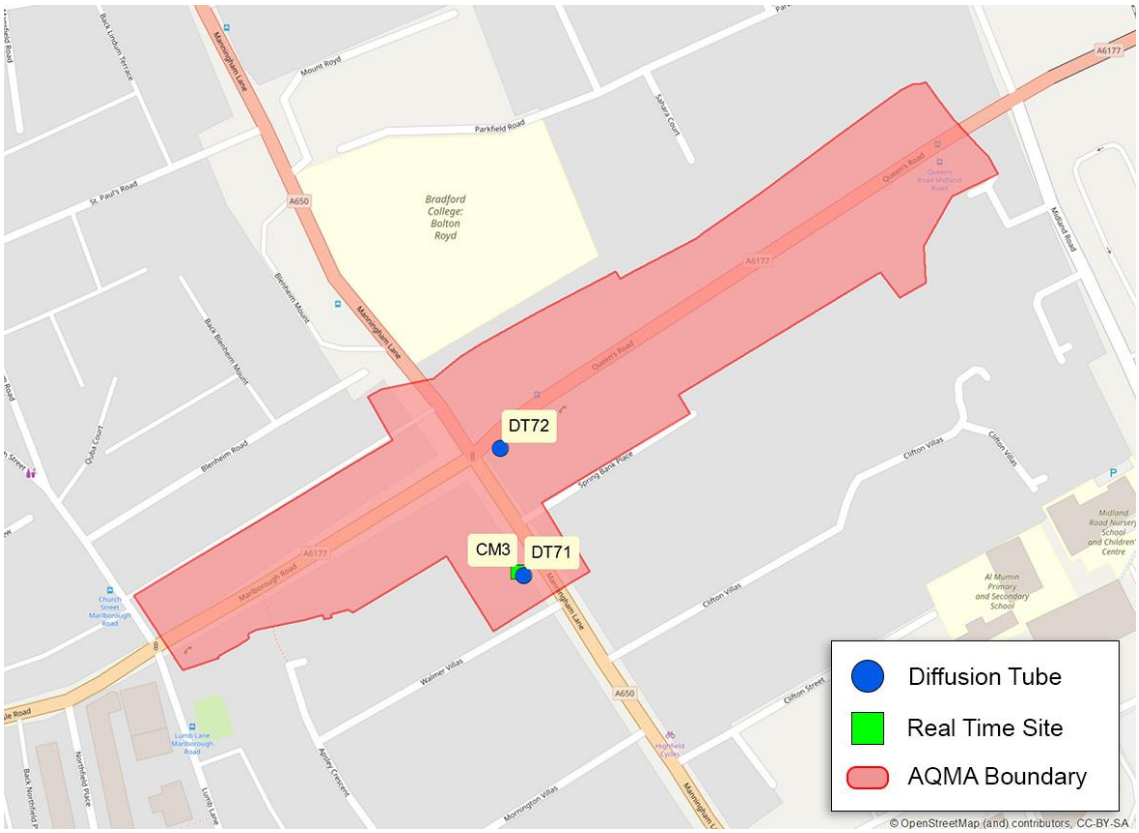
CM5	2.0	2.0	20.5	44.7	**44.7**	Predicted concentration at Receptor above AQS objective.
CM6	2.0	4.0	22.3	48.3	**44.1**	Predicted concentration at Receptor above AQS objective.
CM7	1.5	2.5	19.4	37.8	35.7	
CM8	5.8	5.8	16.9	33.8	33.8	

Appendix D: Map(s) of Monitoring Locations and AQMAs

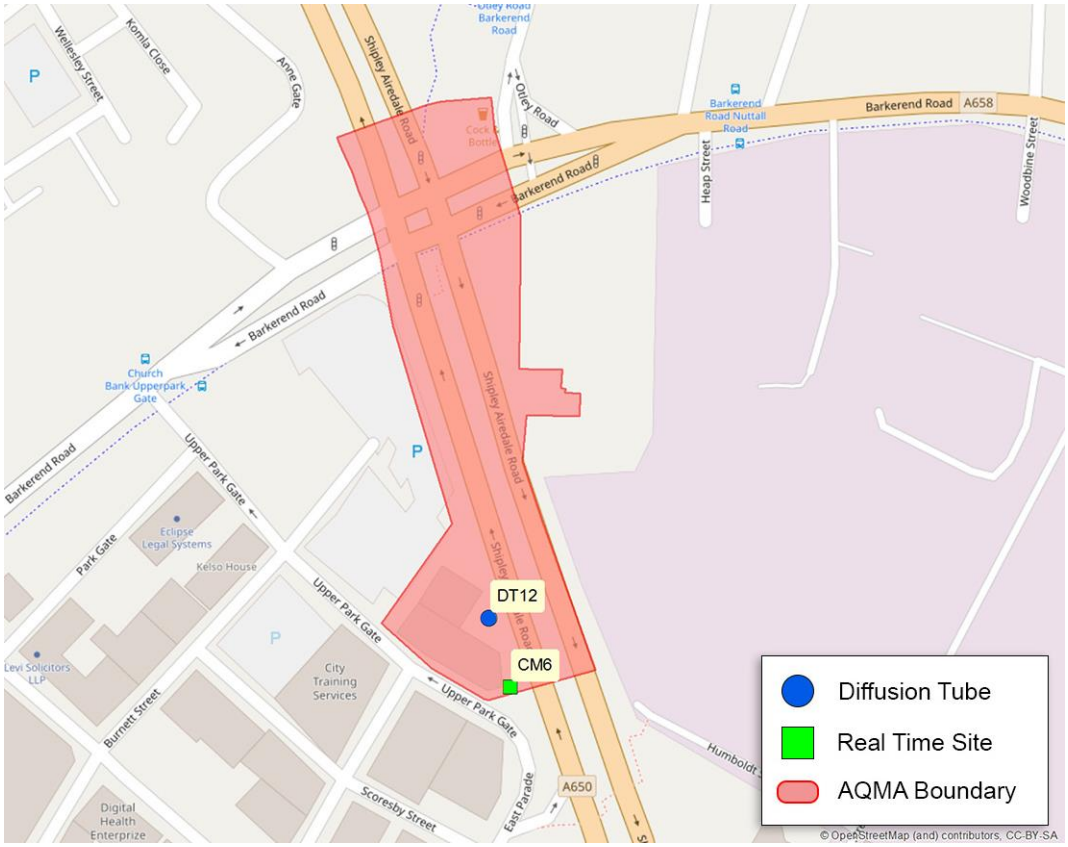
Map 1: Real time monitoring sites in Bradford



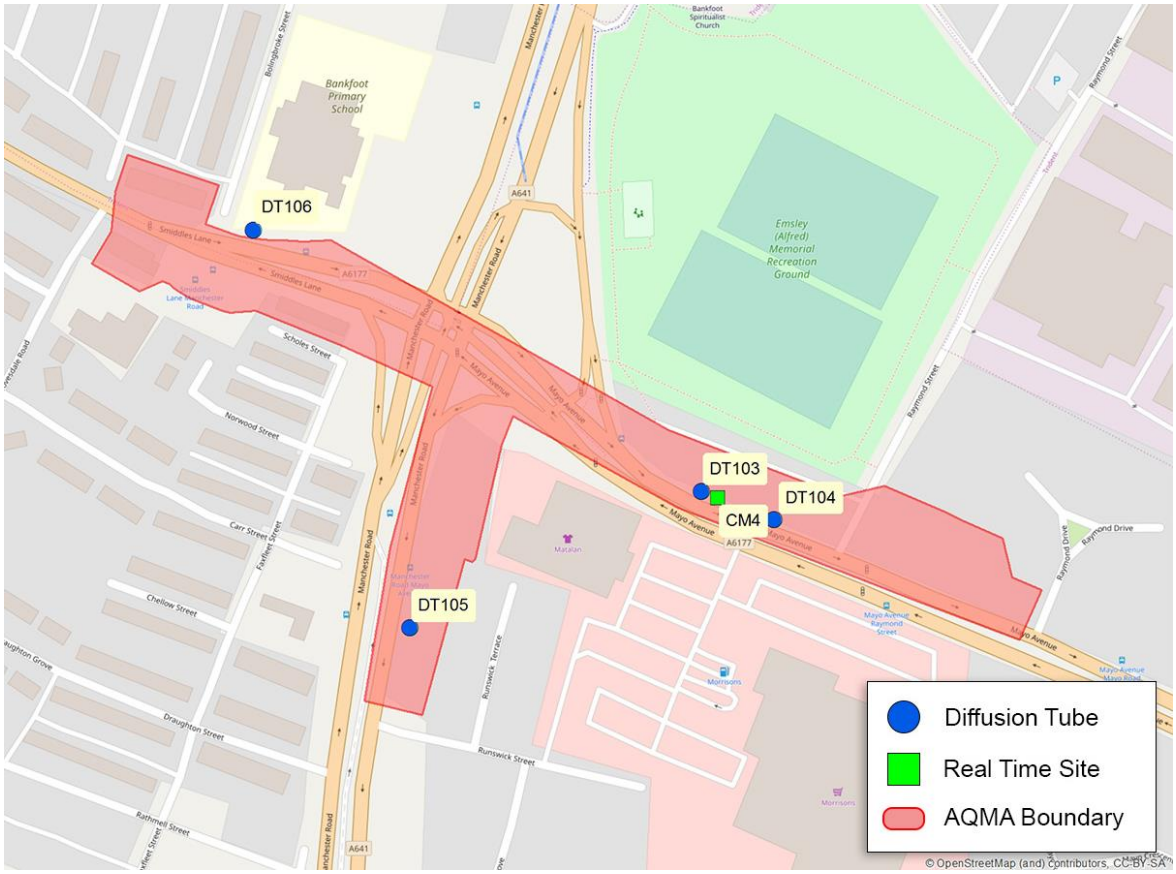
Map 2: Manningham Lane AQMA monitoring sites



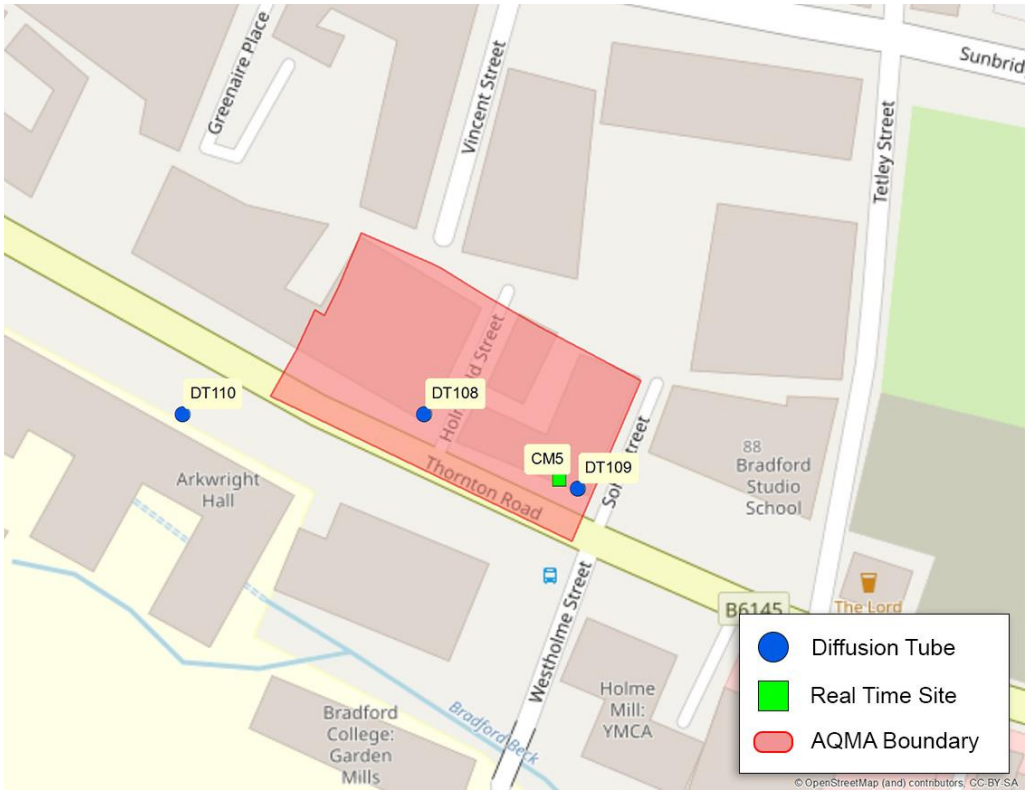
Map 3: Shipley Airedale Road AQMA monitoring sites



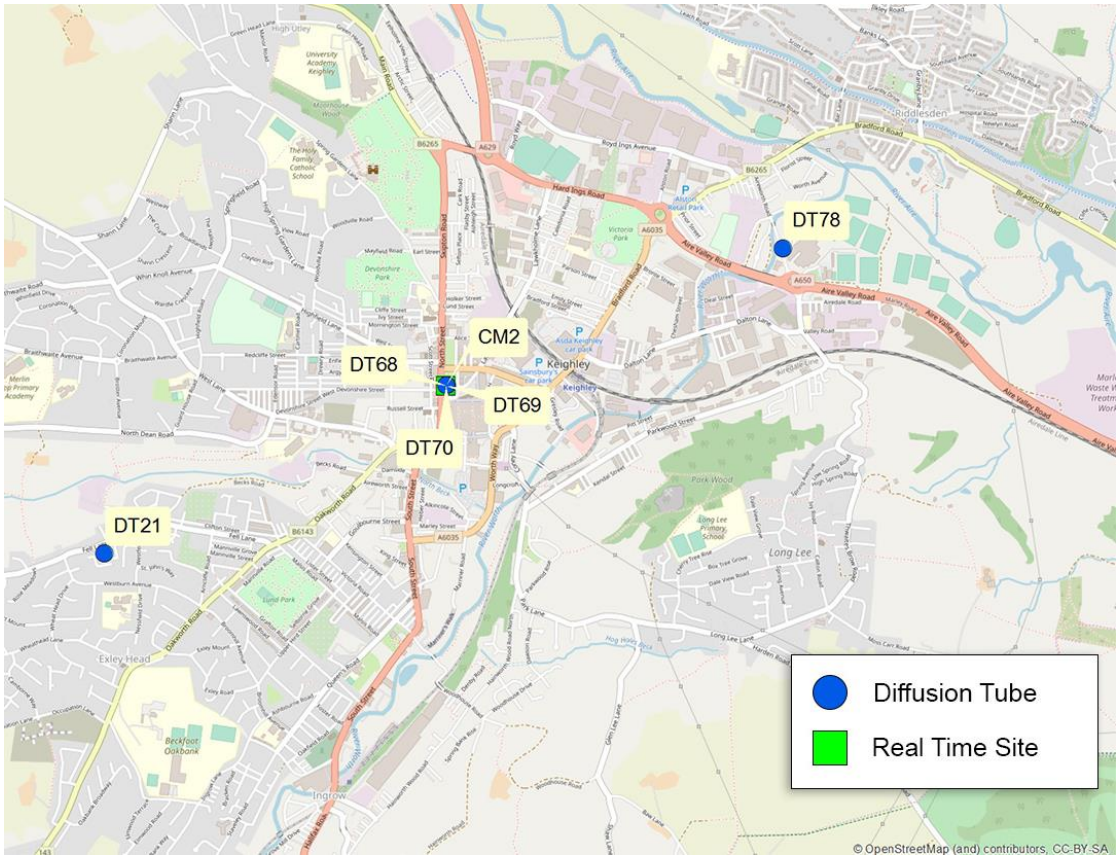
Map 4: Mayo Avenue AQMA monitoring sites



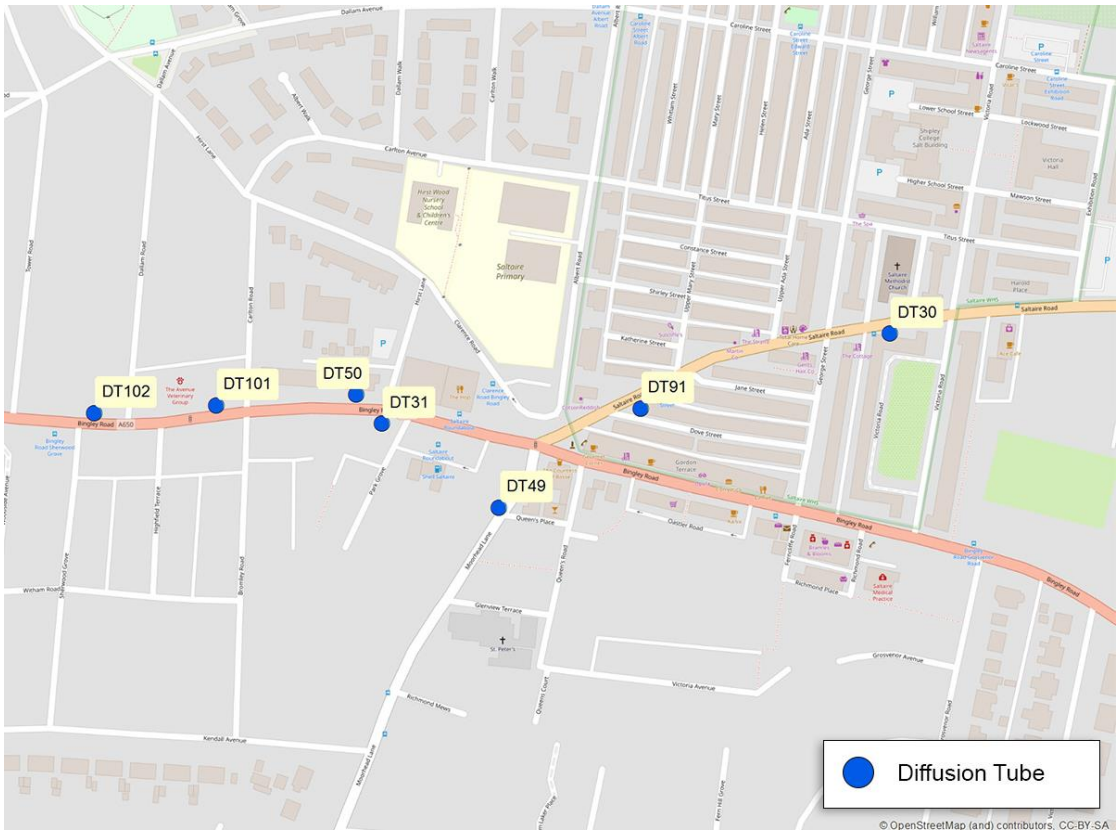
Map 5: Thornton Road AQMA monitoring sites



Map 6: Keighley monitoring sites

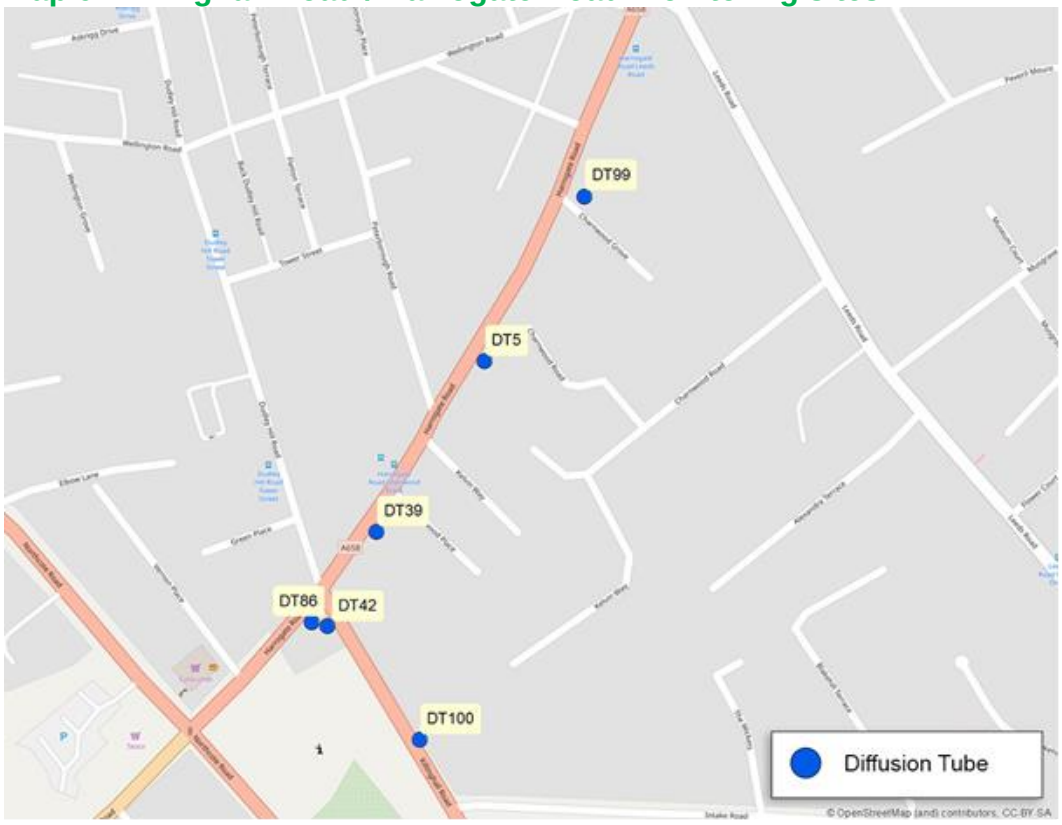


Map 7: Saltaire Road / Bingley Road monitoring sites



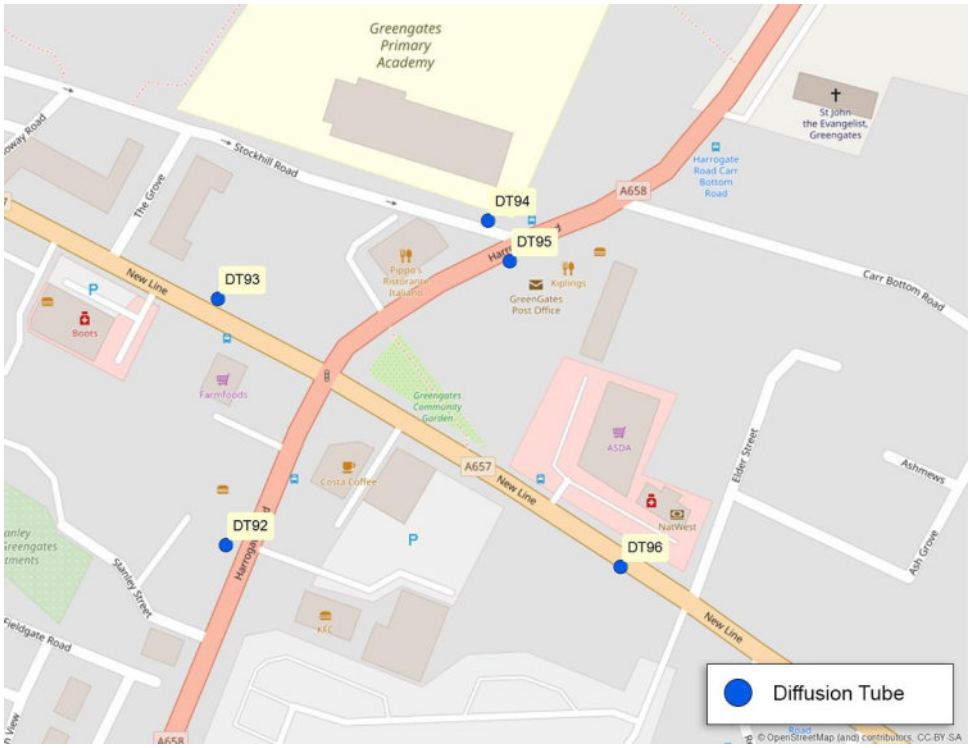
Map 8: Rook Lane / Rooley Lane monitoring sites

Map 9: Killinghall Road / Harrogate Road monitoring sites

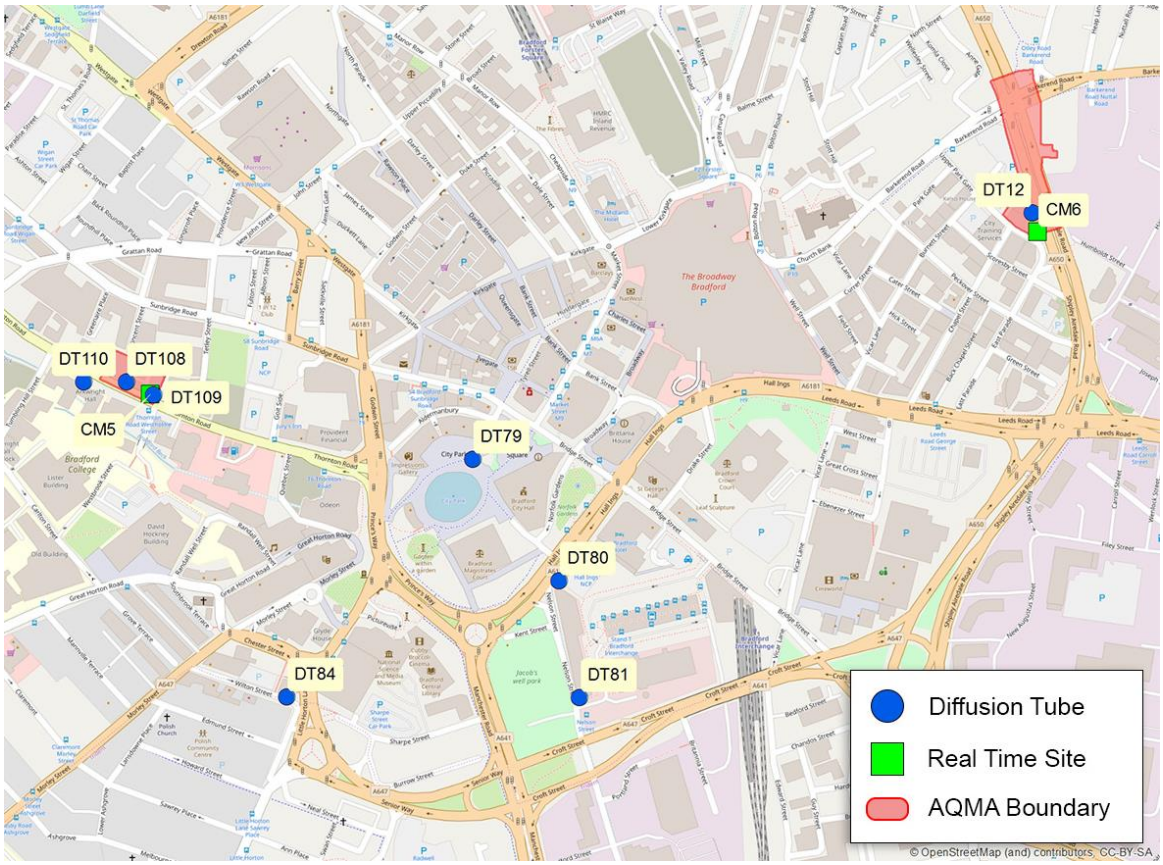


Map 10: Canal Road monitoring sites

Map 11: Greengates crossroads monitoring sites

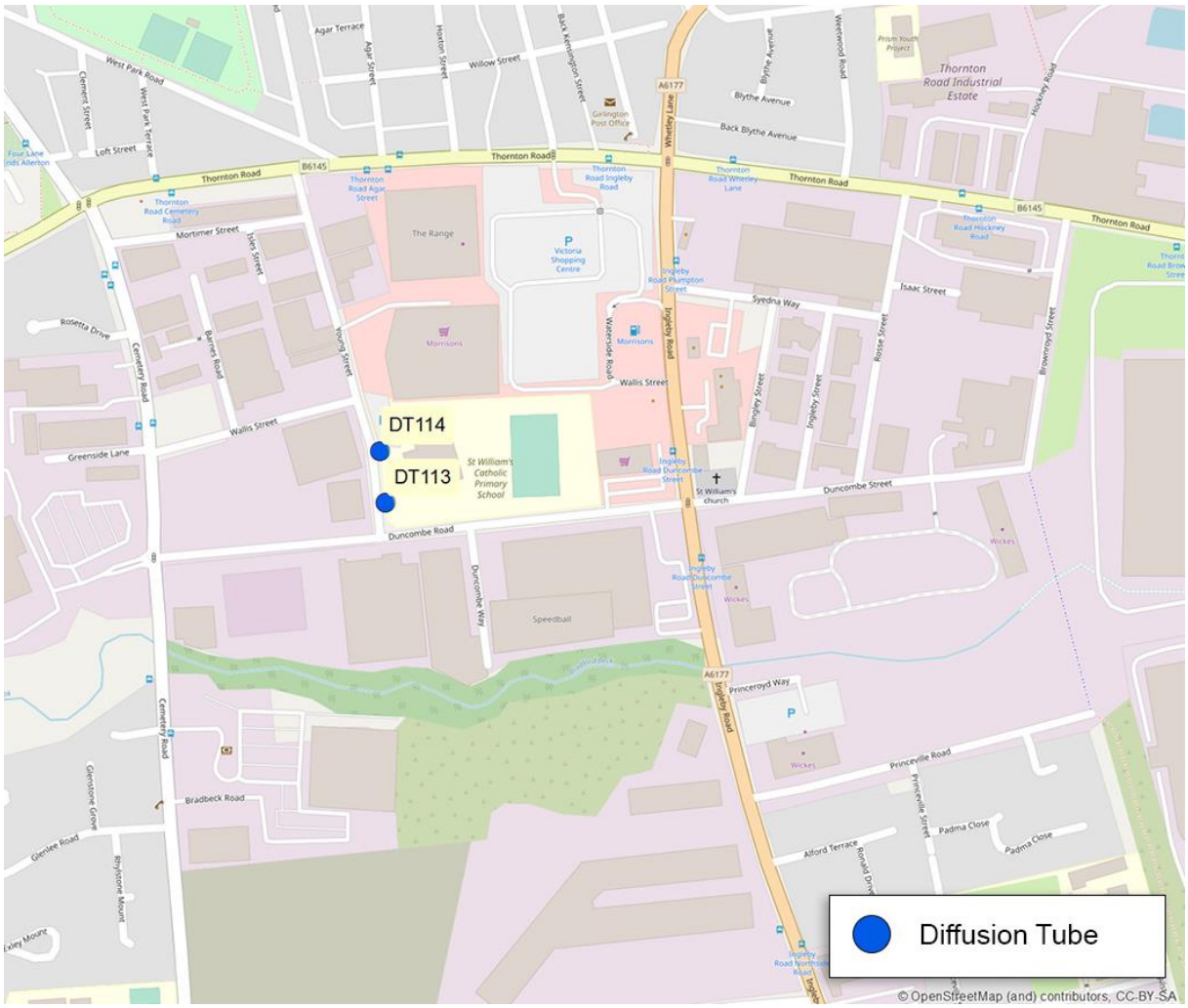


Map 12: City centre monitoring sites



Map 13: Additional monitoring sites to South East of city centre

Map 14: Duncombe Road monitoring sites (baseline for STOR application)



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England

Pollutant	Air Quality Objective[6]	
	Concentration	Measured as
Nitrogen Dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean
	40 µg/m^3	Annual mean
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 35 times a year	24-hour mean
	40 µg/m^3	Annual mean
Sulphur Dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean
	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean
	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean

[6] The units are in microgrammes of pollutant per cubic metre of air (µg/m^3).

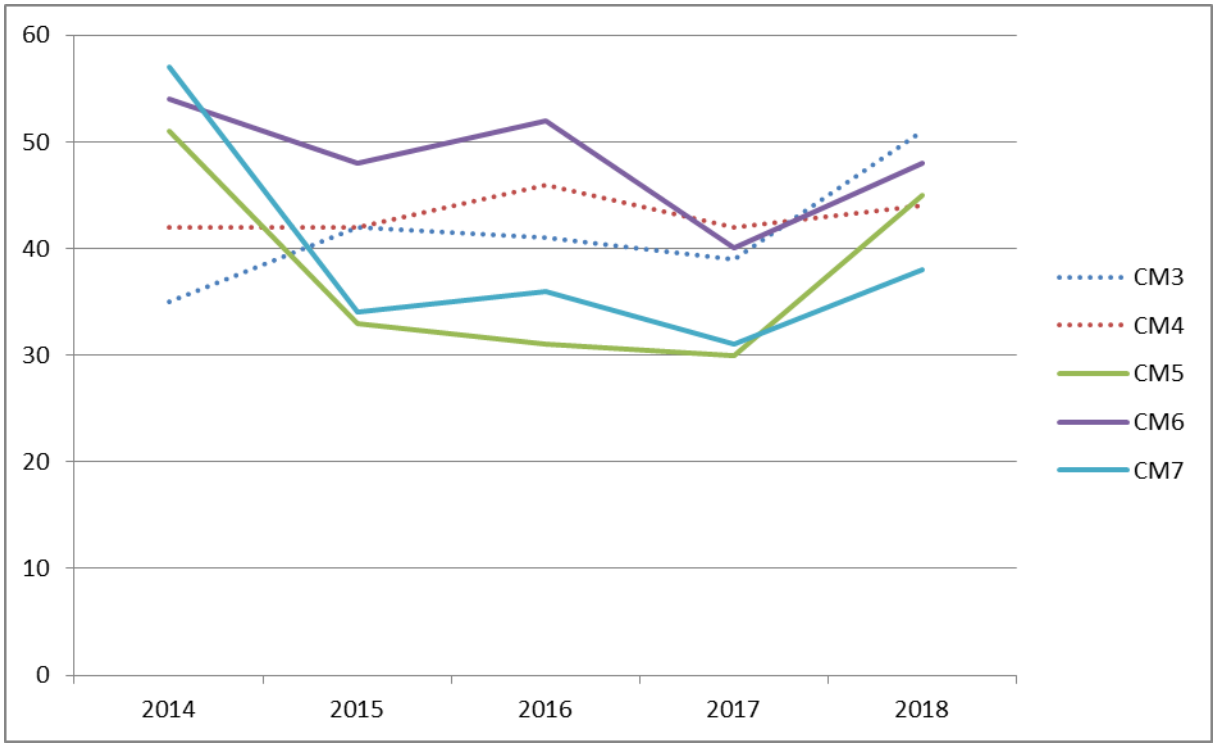
Appendix F: – Thornton Road data anomaly investigation

During the preparation of this report the 2018 annual average NO_2 concentration at the Thornton Road real time monitoring site (CM5) returned an unexpectedly high result of 45µg/m^3 (compared with readings from the previous three years which were in the range of 30 to 33 µg/m^3). This concentration increase was not reflected in the results from the diffusion tubes closest to the monitoring site. An investigation was therefore undertaken into the reason for this anomaly.

Thornton Road real time data trend

When compared to the 5 year results from other real time sites around the city the Thornton Road site (CM5) appears to correlate well with the data trends at CM7 Rook Lane and CM6 (Shipley Airedale Road). All three sites showed a significant (but unexplained) drop in pollutant concentration between 2014 and 2015.

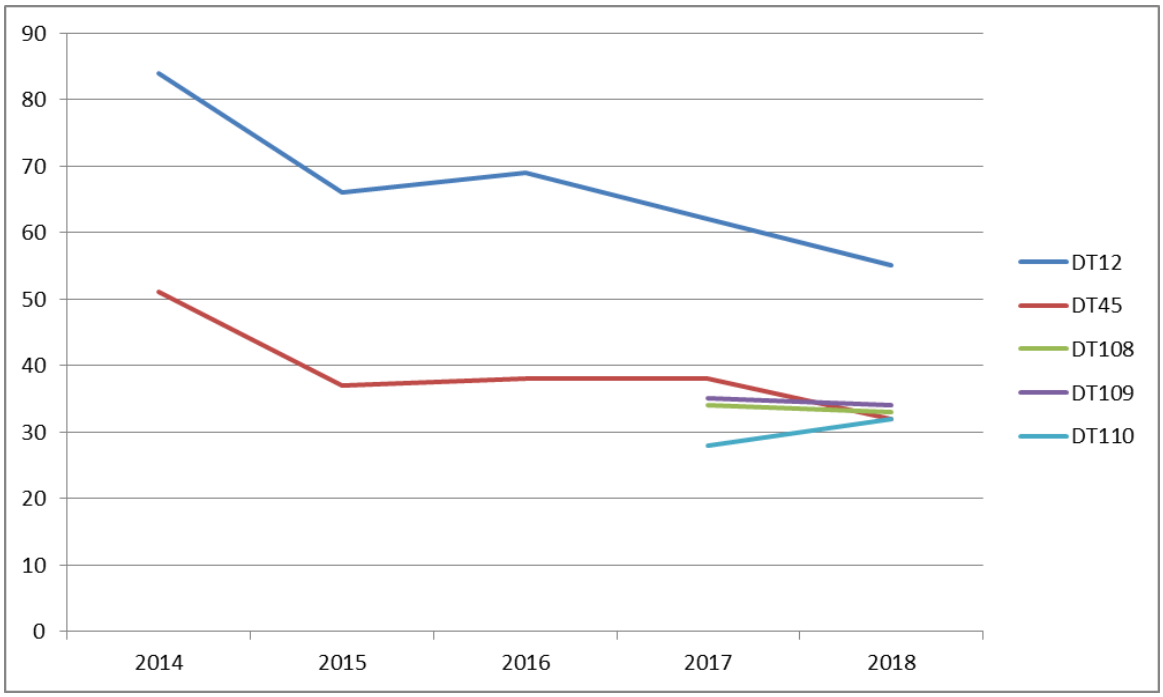
5 year trend in annual average NO_2 at long term real time monitoring sites



This drop off can also be seen in the long term diffusion tube data sets for sites DT12 (close to CM6) and DT45 (close to Rook Lane). Whilst there is no long term diffusion tube trend data for the Thornton Road area, the most recent results for this area

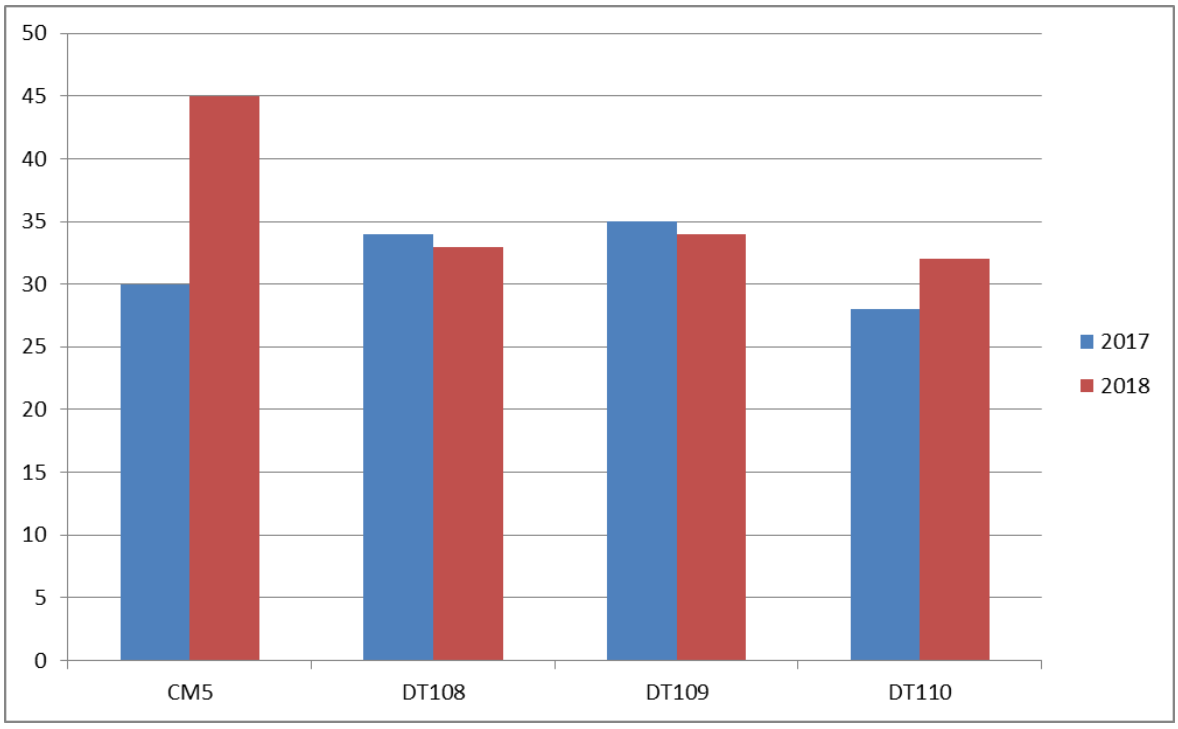
(DT108, DT109 and DT110 established in 2017) correlate well with diffusion tube results for Rook Lane for the same period.

Long term diffusion tube data from sites close to CM7, CM6 and CM5



The diffusion tube results for Thornton Road (DT108, DT109 and DT110) also corresponded well with the Thornton Road real time data (CM5) during 2017.

Real time and diffusion tube data for Thornton Road for 2017 and 2018



Based on these results there was no reason to suspect any issues with either the Thornton Road real time NO_2 data or diffusion tube data prior to the undertaking of this ASR report and analysis of the 2018 data.

Review of Thornton Road data against AURN site (CM4) Mayo Avenue

Since March 2015 the monitoring site at Mayo Avenue has been operated by Defra as part of the national automatic monitoring network https://uk-air.defra.gov.uk/networks/

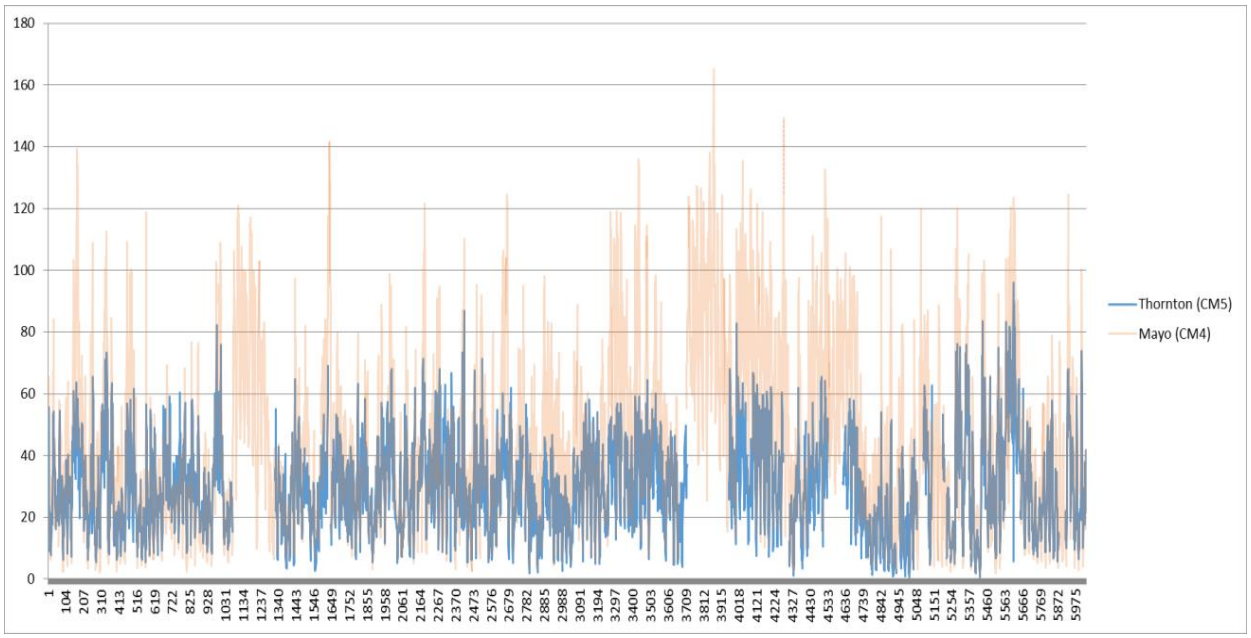
Data for this site is collected and validated independently of City of Bradford MDC (other than the provision of routine local site operator duties). For the purpose of undertaking the Thornton Road data review this site was considered to provide the best independent data set for direct comparison.

The figures below show a direct comparison of the hourly NO_2 data from Thornton Road (CM5) and Mayo Avenue (CM4) for the periods 2015, 2016, 2017 and 2018.

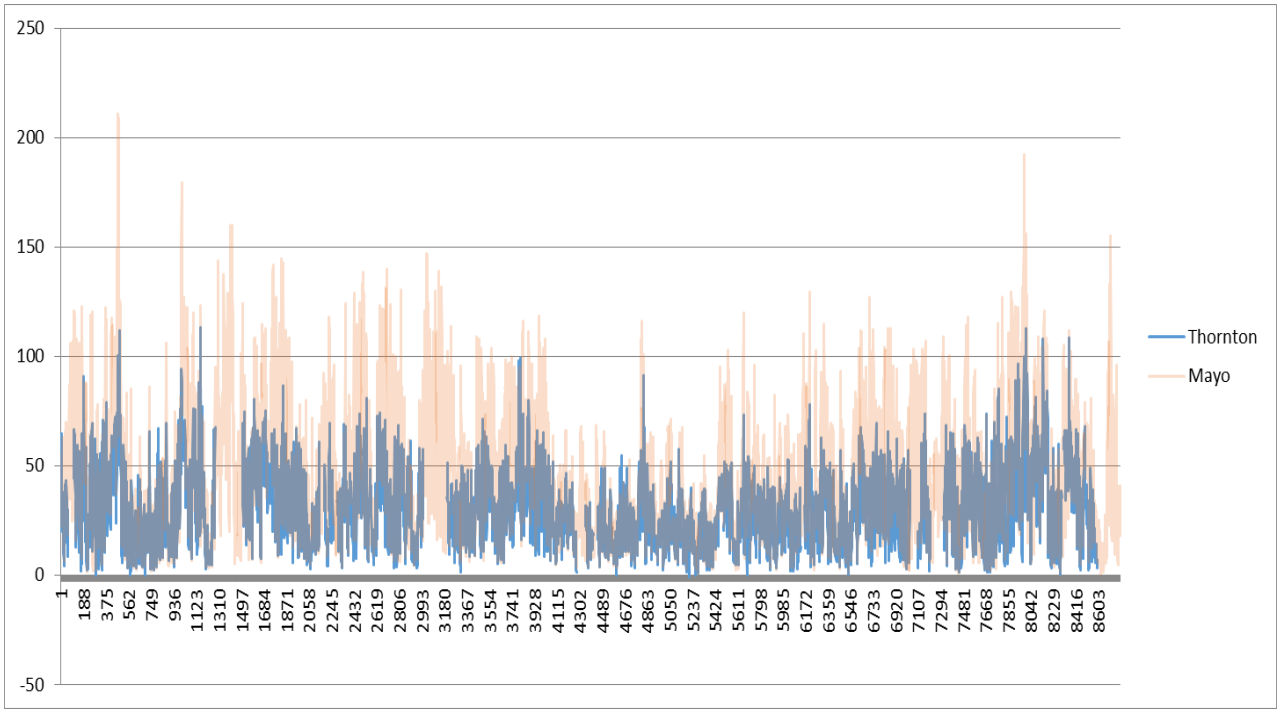
During 2015, 2016 and the first half of 2017 the Thornton Road site (CM5) returned hourly average concentrations that were consistently much lower than those recorded at Mayo Avenue (CM4).

Close examination of the results has identified a step change in the results from Thornton Road following two instrument repairs during June and July 2017. After these repairs hourly NO_2 concentrations recorded at Thornton Road (CM5) increased from August 2017 onwards and started to track those from Mayo Avenue (CM4) more closely. This improved relationship continues throughout 2018 and accounts for the increased annual average concentration recorded at Thornton Road during 2018 compared with the previous years.

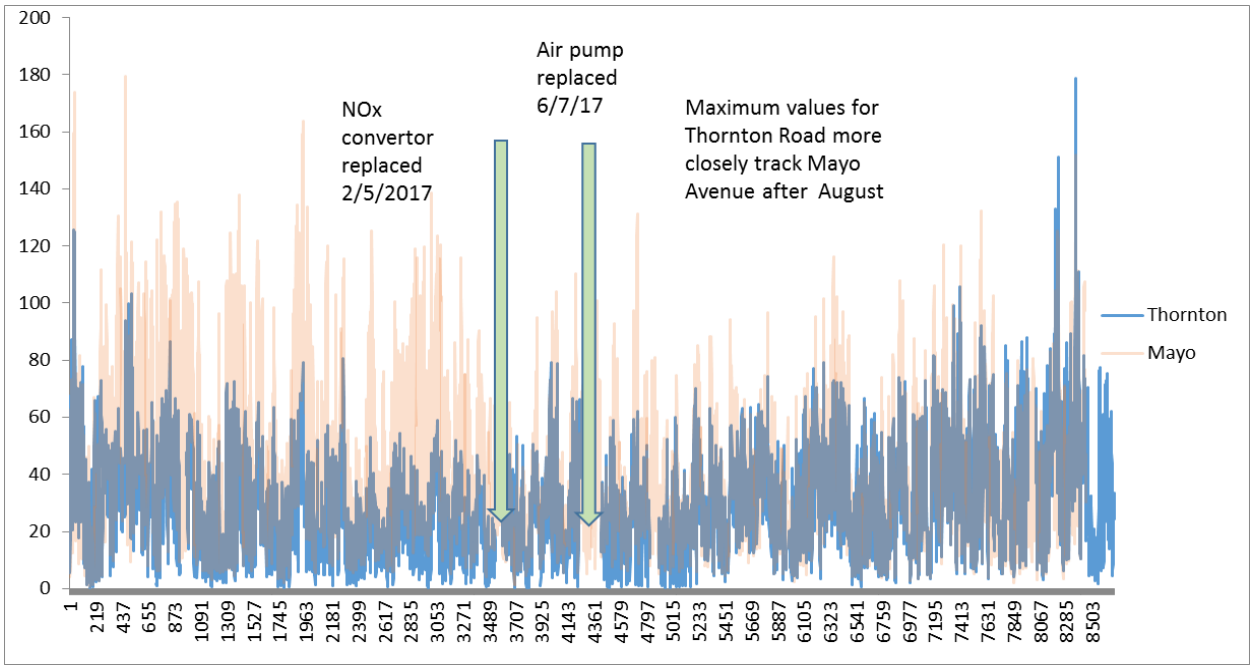
Thornton Road (CM5) v Mayo Avenue (CM4) 2015



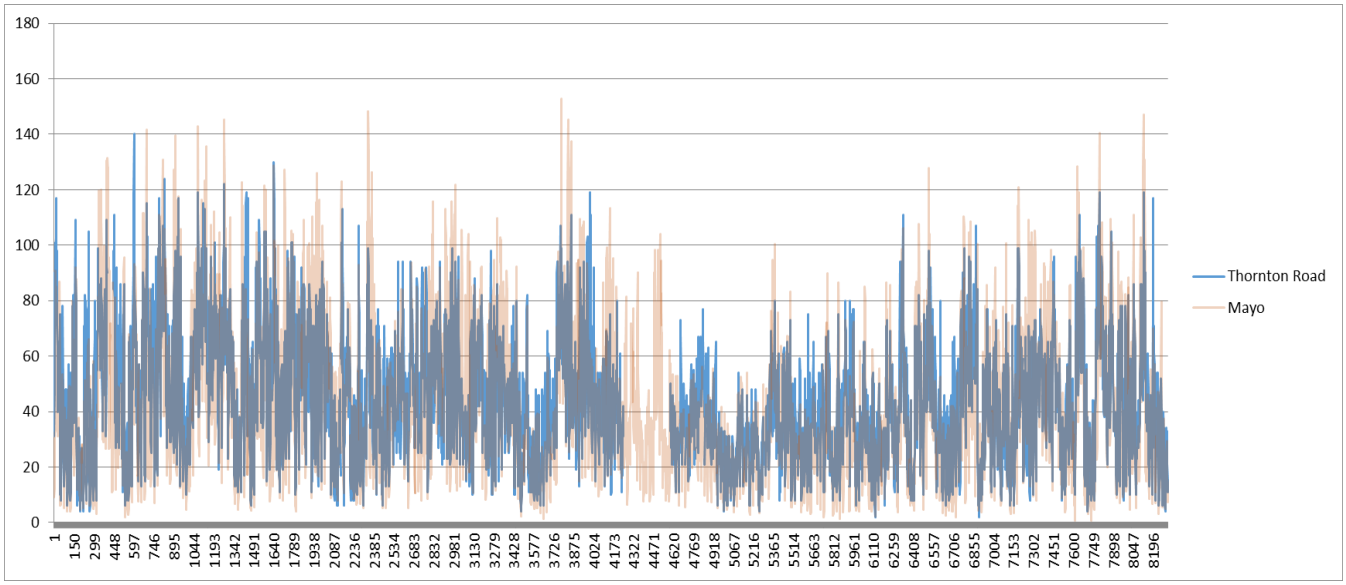
Thornton Road (CM5) v Mayo Avenue (CM4) 2016



Thornton Road (CM5) v Mayo Avenue (CM4) 2017



Thornton Road (CM5) v Mayo Avenue (CM4) 2018



Service records for the Thornton Road real time analyser record two significant repairs to the instrument at Thornton Road prior to August 2017.

5/6/2017 – Instrument NO_x convertor repaired. The NO_x convertor converts NO_2 to NO before the instrument takes a reading of NO_2 concentration. A faulty convertor will result in under-reading on the NO_2 channel. Convertors can degrade over a long period of time and a gradual fall off in NO_2 concentration readings can go unnoticed.

6/7/2017 – Instrument air pump replaced. The site pump failed on 30/5/17 and was replaced on 6/7/2017. The pump may have been faulty for a prolonged period prior to ceasing up and this would have impacted on air flow rates through the analyser impacting on total measured pollutant concentrations.

Both these faults could have had a long term impact on the NO_x analyser performance at Thornton Road prior to August 2017. As such any data from the site prior to this date should be treated with caution.

Monitoring using the real time NO_x analyser and diffusion tubes is continuing at Thornton Road and the results will be reviewed again in 2020. As part of this review, BMDC will undertake a further comparison of NO_2 levels monitored during 2019 at Thornton Rd and Mayo Avenue. Should absolute levels of NO_2 at these sites show good agreement in 2019, this will give added confidence to the 2018 data and confirm that the aforementioned NO_x convertor issue may indeed have been responsible for the low NO_2 values recorded at Thornton Road in previous years.

Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the local authority intends to achieve air quality limit values'
AQMA	Air Quality Management Area – An area where air pollutant concentrations exceed / are likely to exceed the relevant air quality objectives. AQMAs are declared for specific pollutants and objectives
ASR	Air quality Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
PM_{10}	Airborne particulate matter with an aerodynamic diameter of 10µm (micrometres or microns) or less
$PM_{2.5}$	Airborne particulate matter with an aerodynamic diameter of 2.5µm or less
QA/QC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide
STOR	Short Term Operating Reserve

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