Annual Progress Report (APR)

2023 Air Quality Annual Progress Report (APR) for West Lothian Council.

In fulfilment of Part IV of the Environment Act 1995, as amended by the Environment Act 2021

Local Air Quality Management

June 2023

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Executive Summary: Air Quality in Our Area

Air Quality in West Lothian Council

West Lothian Council has continued to review and assess air quality throughout the district in 2022 to determine whether or not air quality objectives are likely to be achieved. Air pollutants Nitrogen Dioxide (NO_2) and fine particles (PM_{10} & $PM_{2.5}$), which are mainly associated with vehicle emissions and domestic fuel burning, are measured using a network of three continuous air quality monitoring stations located in Linlithgow, Broxburn and Newton.

There is also a network of 30 NO_x passive diffusion tubes located at 24 sites throughout West Lothian. A review of diffusion tube locations took place at the end of 2021 and the new sites were in place for 2022. There is one tube located at 21 sites and three tubes co-located with the air quality monitoring stations at Broxburn, Linlithgow and Newton (Sites DT4, DT14 and DT2N respectively) – we also employ 1 travel tube. A diffusion tube (DT24N) was installed in Linlithgow in October 2022, following completion of an updated detailed assessment for the Linlithgow Air Quality management Area. All diffusion tube locations can be found on the Air Quality in Scotland website: https://www.scottishairquality.scot/latest

A diffusion tube location map (Figure 11) is also provided at the end of this report in Appendix C.

During 2022, there were a number of ongoing issues with regard to the equipment at all of our automatic monitoring stations. A new roadside enclosure and NO_x monitor were installed at Newton in July 2022. The optics on the FIDAS monitors in Broxburn and Linlithgow were also replaced during 2022, so a hot spare was installed at the Broxburn enclosure for several months, with a Beta Attenuation Monitor (BAM) installed at Linlithgow whilst the FIDAS was away for repair.

The 2022 monitoring data at all three continuous air quality monitoring stations has shown that the NO_2, PM_{10} and $PM_{2.5}$ long term average air quality objectives have been met. NO_2 levels decreased at all three continuous monitoring sites from the levels found in 2021. PM_{10} levels slightly increased at all 3 continuous monitoring sites in 2022. $PM_{2.5}$ levels remained fairly stable at all 3 sites and were very similar to the levels measured the previous year, with only a very slight increase. There were no exceedances of the short term NO_2 at any

of the three sites. There were 2 exceedances of the 24 hour mean for PM_{10} at Broxburn, however, the objective level is only breached if this level is exceeded more than 7 times in one year.

As many of the diffusion tube locations were updated, comparisons cannot be made with previous years for all sites. For those sites that have remained, it was noted that many of the measured levels have increased from last years measured levels. This will continue to be monitored to see if any further monitoring is required in these areas. However, overall, NO_2 passive diffusion tubes located throughout West Lothian have not shown any exceedances during 2022.

Further information on the location of the AQMA's can be found at https://www.westlothian.gov.uk/article/34729/Air-Pollution

Actions to Improve Air Quality

The actions taken to improve air quality within West Lothian during 2022 include;

- The Eco Stars fleet recognition scheme membership within West Lothian continued to increase during 2022. As of the end of 2022, 148 members (4896 vehicles) are now part of the scheme within the West Lothian Council area. West Lothian Councils own fleet of vehicles are also members of this Eco stars scheme;
- The West Lothian Council electric vehicle fleet remained at 51 electric vehicles in the Council fleet in total during 2022;
- During 2021, a cross-service working group was set up. This group looks at how the Council decarbonises its fleet in line with Scottish Government targets. A report has been submitted to the Executive Management Team with the first major milestone for decarbonising part of the fleet (cars) being introduced from 2025 onwards. The group will look to put together a 'Decarbonising the Councils Fleet' Strategy;
- Some active travel measures that were first introduced during the Coronavirus pandemic remained in place during 2022, namely;
    - Temporary cycle lanes in St Ninians Road and Edinburgh Road in Linlithgow. East Main Street, Broxburn and the A89 through Blackridge;
    - Temporary footway build-outs at Main Street, Mid Calder, Main Street, East Calder, the A71 in West Calder and Station Road in Kirknewton;
    - Footway parking removal at the East Loanings on High Street Linlithgow

A report will be submitted to the Council Executive during 2023 to recommend that some of these measures remain in place permanently whilst others are removed;

- Continued use of electric vehicles within Environmental Health and Trading Standards along with greater use within the Council as a whole. There are plans to implement a vehicle tracking system to improve vehicle utilisation and reduce the need for journeys/additional vehicles. In addition, the Council plan to target alternatively fuelled vehicles within its vehicle replacement program and have already began trials of the latest electric pick-ups and vans;

- Bikeability activities continued during 2022. The scheme was on target for 22 schools to be delivering Level 2 Bikeability to their pupils. This was a record high for West Lothian Council, with the previous highest number of schools delivering Level 2 Bikeability, being 17 (pre-pandemic). This will be 32.4% of our primary schools delivering essential on road cycle training (Level 2 Bikeability) to the young people of West Lothian. Also during the 2022 session –
    - 3 Bikeability Scotland Instructor Courses ran for teachers and volunteers in West Lothian;
    - Increased Bikeability cycle fleet enabling more schools to borrow bikes for Bikeability training in their school;
    - Working with West Lothian Bike Library for the use of adaptive bikes to ensure cycle training is inclusive to all
    - With 34 schools across West Lothian engaged with Bikeability (Level 1 or 2) we have achieved 50% engagement from schools

  The longer term goal is to have 100% of Primary Schools in West Lothian delivering Level 2 Bikeability training to their pupils meaning that all children attending a Primary School in West Lothian will have the opportunity to participate in essential cycle training. In summary;

    - 68 primary schools contacted
    - 26 schools visited
    - 20 Bikeability loan bikes in use
    - 17 schools delivering level 1 Bikeability in terms 1-3
    - 7 schools planning to deliver level 1 Bikeability in term 4
    - 13 schools delivered level 2 Bikeability in terms 1-3
    - 9 schools planning to deliver level 2 Bikeability in term 4

- During 2022, there was further expansion of the publicly available EV charging points installed by West Lothian Council. There are now 16 dual outlet fast chargers, 11 50kW rapid chargers and 5 7kW dual outlet chargers installed throughout different public spaces within West Lothian. During 2022, the Councils EV infrastructure plan was started – it is likely to be published at the end of 2023. In December 2022, the Council agreed to introduce tariffs for the use of its EV charge points. Further details on these charges and the location of the West Lothian Council EV charge points are available at the following link - https://www.westlothian.gov.uk/ev-charging ;
- West Lothian Council also continues to provide the management and administration support for the East Central Scotland Vehicle Emissions Partnership (VEP), which is in collaboration with Stirling Council, East Lothian Council, Midlothian Council and Falkirk Council. The remit of the VEP is to help reduce vehicle emissions by encouraging drivers to switch off their engine whenever possible, encourage good travel modes and vehicle choices and handling idling and emissions complaints. In addition, the VEP uses a broad variety of advertising media to encourage change in driving habits across the councils' areas. Media used includes local TV, radio, public transport networks such as buses and social media.

New EV charging infrastructure at Leisure Centre in Winchburgh

Local Priorities and Challenges

It was noted in the 2021 Annual Progress Report that the priority was to complete detailed assessments for the 3 Air Quality Management Areas, so as to determine whether these required to be revoked due to air pollution levels meeting the target air quality objectives for the previous three years. The detailed assessments were reviewed and completed in October 2022. Following completion of these reports, West Lothian Council began work on the revocation of the Broxburn AQMA for NO_2 and PM_{10}. Work to progress this revocation will continue into 2023 with the required consultations taking place and approval from the various Committees within the Council before a revocation order can be confirmed. Thereafter, the focus will be on the Air Quality Management Areas of Linlithgow and Newton, which will be considered for revocation. Work will also start during 2023 on review of the action plans for all Air Quality Management Areas

Funding applications will continue to be made to the Scottish Government for monitoring equipment and action plan measures.

During 2022 we implemented our new diffusion tube locations. We will continue to review these and move any locations as necessary.

How to Get Involved

If you would like to find out more about air quality within West Lothian, please visit the Air Pollution pages of our website at https://www.westlothian.gov.uk/article/34729/Air-Pollution

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1 Local Air Quality Management

This report provides an overview of air quality in West Lothian Council during 2022. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995), as amended by the Environment Act (2021), 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 Progress Report (APR) summarises the work being undertaken by West Lothian Council to improve air quality and any progress that has been made.

Table 1.1 – Summary of Air Quality Objectives in Scotland

Pollutant	Air Quality Objective Concentration	Air Quality Objective Measured as	Date to be Achieved by
Nitrogen dioxide (NO_2)	200 µg/m^3 not to be exceeded more than 18 times a year	1-hour mean	31.12.2005
Nitrogen dioxide (NO_2)	40 µg/m^3	Annual mean	31.12.2005
Particulate Matter (PM_{10})	50 µg/m^3, not to be exceeded more than 7 times a year	24-hour mean	31.12.2010
Particulate Matter (PM_{10})	18 µg/m^3	Annual mean	31.12.2010
Particulate Matter ($PM_{2.5}$)	10 µg/m^3	Annual mean	31.12.2021
Sulphur dioxide (SO_2)	350 µg/m^3, not to be exceeded more than 24 times a year	1-hour mean	31.12.2004
Sulphur dioxide (SO_2)	125 µg/m^3, not to be exceeded more than 3 times a year	24-hour mean	31.12.2004
Sulphur dioxide (SO_2)	266 µg/m^3, not to be exceeded more than 35 times a year	15-minute mean	31.12.2005
Benzene	3.25 µg/m^3	Running annual mean	31.12.2010
1,3 Butadiene	2.25 µg/m^3	Running annual mean	31.12.2003
Carbon Monoxide	10.0 mg/m^3	Running 8-Hour mean	31.12.2003

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMA's) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority must prepare, publish and implement an Air Quality Action Plan (AQAP) within 12 months, setting out measures it intends to put in place in pursuit of the objectives. Whilst West Lothian Council has three declared AQMA's, only one, Broxburn has a finalised action plan. The other two, Linlithgow and Newton, remain as draft action plans. As detailed later in this report, successive years of monitoring data within the AQMA's has shown that air pollution objective limits are being met comfortably. The Council's focus has therefore turned to the revocation of these AQMA's, although progress has so far been slow in actioning this, for various reasons.

Updated detailed assessments for the three AQMA's were completed in October 2022. Work then started in late 2022 on the process of revoking the Broxburn AQMA for NO_2 and PM_{10}. The detailed assessment for Broxburn considered;

- A review of measured NO_2, PM_{10} and $PM_{2.5}$ concentrations within the AQMA over recent years;
- Detailed dispersion modelling of NO_2, PM_{10} and $PM_{2.5}$ concentrations for a baseline year of 2017;
- A sensitivity analysis of potential fluctuations in annual mean pollutant concentrations attributable to meteorological conditions;
- Detailed dispersion modelling of NO_2, PM_{10} and $PM_{2.5}$ concentrations in a future year of 2025, reflecting anticipated changes in traffic levels associated with projected growth or planned local developments.

In considering all the information available from several years of monitoring and from modelling carried out in the 2022 detailed assessment, West Lothian Council intend to revoke the AQMA for both NO_2 and PM_{10}. The Council will, however, continue to monitor NO_2 and PM_{10} within Broxburn. If measured levels remain below the objective levels, the monitoring equipment may be utilised at other potential areas of identified poor air quality within the Council area.

A summary of AQMAs declared by West Lothian Council can be found in **Error! Reference source not found.**. Further information related to declared or revoked AQMAs, including maps of AQMA boundaries are available online at AQMA webpage.

It is West Lothian Council's intention to revoke all of our AQMA's over the next few years, as pollutant levels have remained well below objectives over several years.

Table 2.1 – Declared Air Quality Management Areas

AQMA Name	Pollutants and Air Quality Objectives	City / Town	Description	Action Plan
AQMA Linlithgow	• NO_2 annual mean • PM_{10} annual mean	Linlithgow	Includes Linlithgow, Linlithgow Bridge and land allocated for development	Draft Action Plan
AQMA Broxburn	• NO_2 annual mean • PM_{10} annual mean	Broxburn	West Main Street eastwards to western boundary of service station, Broxburn	Action Plan
AQMA Newton	• PM_{10} annual mean	Newton	The whole of Newton village	Draft Action Plan

2.2 Cleaner Air for Scotland 2

Cleaner Air for Scotland 2 – Towards a Better Place for Everyone (CAFS2) is Scotland's second air quality strategy. CAFS2 sets out how the Scottish Government and its partner organisations propose to further reduce air pollution to protect human health and fulfil Scotland's legal responsibilities over the period 2021 – 2026. CAFS2 was published in July 2021 and replaces Cleaner Air for Scotland – The Road to a Healthier Future (CAFS), which was published in 2015. CAFS2 aims to achieve the ambitious vision for Scotland "to have the best air quality in Europe". A series of actions across a range of policy areas are outlined, a summary of which is available on the Scottish Government's website.

Progress by West Lothian Council against relevant actions for which local authorities are the lead delivery bodies within this strategy is demonstrated below.

2.2.1 Placemaking – Plans and Policies

Local authorities with support from the Scottish Government will assess how effectively air quality is embedded in plans, policies, City Deals and other initiatives, and more generally in cross departmental working, identifying and addressing evidence, skills, awareness and operational gaps.

The council's current Active Travel Plan (ATP) for West Lothian, 2016-21 "Making Active Connections" is a plan to link people to places by active travel. It is not just about physical connections however - it is also a framework for mainstreaming active travel in West Lothian, and creating a culture where active travel becomes the norm for suitable everyday trips. To achieve this, it is crucial that West Lothian Council works successfully with external partners, schools and local communities, and "joins up" policies and projects delivered by different Services and teams across the Council. Embedding positive behaviours at an early age is essential, and schools throughout West Lothian encourage pupils to use active travel methods, emphasising the health, wellbeing and environmental benefits. The current plan is going to be updated, with the Active Travel Plan Refresh 2023-2028 survey currently out for public opinion, closing on Monday 5th June 2023.

West Lothian Council also has a 'decarbonising the fleet' working group that is actively developing a strategy to reduce the impact of vehicle emissions from the Council fleet of vehicles.

There is a climate change group which also meets regularly to discuss and consolidate issues around the climate change emergency which includes matters linked to air quality.

There are further initiatives focussing on the Councils more remote housing stock (Westfield/Wilkieston), to replace oil fired and coal fired heating systems with more modern solutions such as heat pumps. This will help to improve the local air quality in these areas.

Other relevant policies and plans which also contain initiatives that affect air quality include;

- West Lothian Local Outcomes Improvement Plan 2013-2023
- Regional Transport Strategy, Local Transport Strategy, Green Transport Strategy 2008-2023, West Lothian Local Plan

- Supplementary Planning Guidance, including the one on Air Quality 2018
- West Lothian Climate Change Strategy 2021-2028
- Space Strategy, Active Travel Plan 2016-2021
- West Lothian Local Development Plan 2018

2.2.2 Transport – Low Emission Zones

Local authorities working with Transport Scotland and SEPA will look at opportunities to promote zero-carbon city centres within the existing LEZs structure.

Low Emission Zones have not yet been considered appropriate for implementation within West Lothian Council.

2.3 Implementation of Air Quality Action Plan(s) and/or measures to address air quality

In order to ensure that local authorities implement the measures within an action plan by the timescales stated within that plan, the Scottish Government expects authorities to submit updates on progress through the APR process. West Lothian Council has taken forward a number of measures within the action plan during the current reporting year of 2022 in pursuit of improving local air quality and meeting the air quality objectives within the shortest possible time. Details of all measures completed, in progress or planned are set out in **Error! Reference source not found.**. More detail on these measures can be found in the air quality Action Plan relating to each AQMA and also the various plans and strategies noted in Section 2.1 of this report.

Key completed measures for this reporting year are:

- Continued progress with the EcoStars fleet management scheme within West Lothian;
- Further update and use of electric vehicles within the Council's fleet management scheme;
- Further progress in the installation of Council operated electric vehicle charging points;
- Detailed assessments for all 3 AQMA's were updated;
- Work started on the revocation of the Broxburn AQMA;
- Replacement of FIDAS optics at Broxburn and Linlithgow;
- Ongoing LSO training of staff within Environmental Health;

- New diffusion tube locations implemented and monitoring started January 2022.

West Lothian Council expects the following measures to be completed over the course of the next reporting year:

- The Broxburn Air Quality Management Area shall be revoked. A period of consultation will take place during 2023 for this planned revocation. It is hoped that the AQMA can be revoked by the end of 2023. An action plan will remain in place for the area and it is hoped a working group can be set up to review this regularly. Monitoring will also continue at the automatic monitoring site in Broxburn, to ensure that levels remain below air quality targets.
- It is hoped that work will begin on the revocation of the other AQMA's;
- A review of the current Air Quality Action Plans will be started, with a view to completing these by early 2024.

Table 2.2 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Expected/Actual Completion year	Measure Status	Funding Status	Key Milestones	Progress	Barriers to implementation
1	Electric Vehicle Charging Point Installation	Promoting low emission transport	Ongoing	In progress	Funding was provided through Transport Scotland's Local Authority Installation Programme (LAIP).	Installation of EV charging points	Ongoing programme of installing chargers on Council land.	Nothing specific to the previous projects. There may be generic barriers such as funding and infrastructure requirements such as the availability of suitable electricity supplies.
2	Active Travel and Cycling Infrastructure	Promoting Travel Alternatives	Ongoing	In progress	Cycling Walking and Safer Routes grant funding WLC received from Transport Scotland Annual SG Funding	During 2022 3 x Bikeability Scotland Instructor Courses ran for teachers and volunteers in West Lothian; Increased Bikeability cycle fleet enabling more schools to borrow bikes for Bikeability training in their school; Working with West Lothian Bike Library for the use of adaptive bikes to ensure cycle training is inclusive to all;	The following projects were delivered in 22/23 at a total cost of £1.174M: A706/B7066 from Whitdale Roundabout to Boghead Roundabout cyclepath; B8084 at Tippethill House Nursing Home – provision of bus lay-by and crossing; Improvements to pedestrian crossings at Traffic Signal Junctions and pedestrian and cycle crossings; Removing barriers to accessibility by providing dropped kerbs	

						With 34 schools across West Lothian engaged with Bikeability (Level 1 or 2) we have achieved 50% engagement from schools.	at various locations throughout West Lothian.	
3	Removal of solid fuel fires in Council housing in Newton	Promoting low emission plants	This is ongoing, some residents have refused the air source heat pumps so they will not be installed until the tenant moves out. Other more rural housing areas within the Council are also being targeted with this initiative.	In progress	Funding is via the Housing Revenue Account budget which is part of a 5 year housing capital improvements programme budget for Council owned housing stock. Budgets are monitored throughout the year and reviewed annually.	Installation of air source heat Pumps in all 12 Council properties in Newton. 7 homes have been completed, 5 still to go	The Council owns 12 homes in Newton, so far 7 have had air source heat pumps installed, with 5 still to be done.	ASHP have been in short supply due to manufacturing issues brought about by the pandemic and so no further installations have taken place during 2022.
4	Electric pool cars for Council staff in AQMA	Promoting low emission transport	2021	Complete d	Funding awarded annually through the SG's Switched on Fleets programme.	Pool cars available for use in Linlithgow	Four electric pool cars in use. Removal of petrol and diesel vehicles	Direction from the SG is that funding is now to be solely used for infrastructure projects rather than the acquisition of electric vehicles.
5	Ecostars fleet recognition scheme	Promoting low emission transport	Ongoing	In progress	Annual SG Funding	As of October 2022, West Lothian has 148 members and 4896 vehicles in the scheme.	Ongoing programme of recruiting members and vehicles.	Reduced funding from SG

3 Air Quality Monitoring Data and Comparison with Air Quality Objectives

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

This section sets out what monitoring has taken place and how local concentrations of the main air pollutants compare with the objectives.

West Lothian Council undertook automatic (continuous) monitoring at 3 sites during 2022. **Error! Reference source not found.** in Appendix A shows the details of the sites. National monitoring results are available at https://www.scottishairquality.scot/

Maps showing the location of the monitoring sites are provided in Figure 12. Further details on how the monitors are calibrated and how the data has been adjusted are included in Appendix C.

New Automatic Monitoring Enclosure at Newton – installed in 2022

3.1.2 Non-Automatic Monitoring Sites

West Lothian Council undertook non- automatic (passive) monitoring of NO_2 at 24 sites during 2022. **Error! Reference source not found.** in Appendix A shows the details of the sites. Following the update of the detailed assessments, modelling highlighted an area of concern within Linlithgow, so an additional diffusion tube was installed (DT24N) within that area in September 2022.

Maps showing the location of the monitoring sites are provided in Figure 11. Further details on Quality Assurance/Quality Control (QA/QC), annualisation and bias adjustment for the diffusion tubes are included in Appendix C.

New Diffusion Tube Location – Uphall Station – Installed In September 2022

3.1.3 Other Monitoring Activities

There were no other monitoring activities carried out within West Lothian Council during 2022.

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

Error! Reference source not found. in Appendix A compares the ratified and adjusted monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40 µg/m^3. The table shows that the annual mean objective was met at all three continuous monitoring sites, along with all of the diffusion tube locations. It was noted that data capture was poor at the Newton site – this was due to replacement of the equipment at this site during 2022. NO_2 levels were lower at all three continuous monitoring sites than the previous year.

For diffusion tubes, the full 2022 dataset of monthly mean values is provided in Appendix B.

Error! Reference source not found. in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past five years with the air quality objective of 200µg/m^3, not to be exceeded more than 18 times per year. There were no exceedances for this objective during 2022, although poor data capture at the Newton site is noted. West Lothian Council has consistently met this objective at the 3 continuous monitoring stations, with only one exceedance at Linlithgow in 2019.

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 five years with the air quality objective of 18µg/m^3. All three continuous monitoring sites have remained within the objective limit. It is noted that there was poor data capture at both the Newton and Linlithgow sites. For Linlithgow, some data was removed during the ratification process as it was determined that the TIDF diagnostic on the FIDAS instrument was outside the allowable parameters, which in turn caused the measured concentrations to drop erroneously. Data for Newton and Linlithgow was therefore annualised and annualisation means are shown in brackets in table A.5. In addition to this, the data has had a factor applied to it in line with guidance issued by the Scottish Government, for particulate data measured by a FIDAS analyser. The results remain below objective levels.

Error! Reference source not found. in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past five years with the air quality objective of 50µg/m^3, not to be exceeded more than seven times per year. There were 2 exceedances of this limit at the Broxburn site during 2022. The objective limit requires that this limit not be exceeded more than seven times per year. Although there were 2 individual exceedances, this objective limit was not breached.

3.2.3 Particulate Matter ($PM_{2.5}$)

Error! Reference source not found. in Appendix A compares the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past five years with the air quality objective of 10µg/m^3. Whilst $PM_{2.5}$ levels were slightly higher than the previous year, there were no exceedances of this objective at any of the continuous monitoring sites. There was poor data capture at the Linlithgow and Newton sites. Similarly, with the PM_{10} data at Linlithgow, $PM_{2.5}$ data was removed during the ratification process as it was discovered that that the TIDF diagnostic on the FIDAS instrument was outside the allowable parameters, which in turn caused the measured concentrations to drop erroneously.

3.2.4 Sulphur Dioxide (SO_2)

During 2022, no monitoring of SO_2 was carried out within West Lothian.

3.2.5 Carbon Monoxide, Lead and 1,3-Butadiene

There was no monitoring of Carbon monoxide, Lead or 1,3-Butadiene within West Lothian during 2022.

4 New Local Developments

4.1 Road Traffic Sources

There were a number of new roads sources constructed in 2022 but these were mainly associated with new housing developments. The construction of the new M9 junction at Winchburgh was underway during 2022 with completion due in 2023.

4.2 Other Transport Sources

There were no new other transport sources in 2022.

4.3 Industrial Sources

0151/P/22 - Land to North and South of A705 Cousland Farm, Livingston, West Lothian

Planning permission in principle for a 24.9ha mixed use development for business (Class 4), industrial (Class 5) and storage and distribution (Class 6) with associated engineering, landscaping and drainage works.

Note - Planning permission was refused for this application, but it may come back in another year so it is worthy of note.

SEPA provided details on the following new/substantially varied industrial processes which had licences issued/varied during 2022;

- New Part B authorisation was issued for a service station at Livingston Service Station, Almondvale South, Livingston, EH54 6FX. The applicant was Euro Garages Ltd and the licence reference number is PPC/B/5002446;
- PPC/B/1000036 - PPC Part B authorisation at Nettlehill Road, Houston Industrial Estate, Livingston, EH54 5DL. Applicant is Elementis UK Limited. Process involves Organic Chemicals. This was an Operator Technical (Substantial) Variation to an existing Authorisation;
- PPC/B/5003180 - PPC Part B authorisation at GNNR, Gas Peaking Project, 3 Nairn Road, Deans Industrial Estate, Deans, Livingston, EH54 8AY. The applicant was Greenspan Nifty Fifty Limited. The process involves the PPC(B) - Combustion of Fuels. This was a new licence;

- PPC/B/5002633 - PPC Part B authorisation at 2 Simpson Parkway, Kirkton Campus, Livingston, West Lothian, EH54 7BH. Applicant was Cazoo Ltd. The process involves PPC(B) - Coating & Printing and Textile Treatments. This was a new licence;
- WML/L/5001918 – Waste Management Licence at Unit 51, Burnhouse Industrial Estate, Whitburn, EH47 0LQ. The applicant was Erith Contractors Limited. This was a new licence. No further details were provided on the type of waste licence.

4.4 Commercial and Domestic Sources

Installation of domestic wood burning stoves continued to grow within West Lothian during 2022. There have been several planning applications received either within or out-with the AQMA's during 2022. These applications are generally given consent subject to flue height and applicants are given advice in line with DEFRA requirements for exempt appliances and authorised fuels. During 2021, the Environmental Health team started to record the details of wood burning stove applications and this assists in identifying potential hot spot areas. There were no applications for any larger scale commercial or domestic developments during 2022.

4.5 New Developments with Fugitive or Uncontrolled Sources

There were no new fugitive or uncontrolled sources during 2022.

5 Planning Applications

West Lothian Council has processed the following applications in 2022 which might affect air quality:

1194/P/18 – Land surrounding Gavieside Farm, Livingston, West Lothian

Planning permission in principle for mixed use development including housing (maximum 2500 homes), neighbourhood centre, site for primary school. Employment uses and open space with associated transportation, drainage and landscape infrastructure (EIA development).

The air quality impact assessment can be found here:

https://planning.westlothian.gov.uk/publicaccess/files/0B1F2D52E7219AF8636F8582084F11A3/pdf/1194_P_18-EIA_VOL_2_-_APP_G_AIR_QUALITY_ASSESSMENT_AND_DISTRICT_HEAT_NETWORK_APPRAISAL-2750899.pdf

The assessment predicts air quality impacts using the detailed dispersion modelling methods set out in the current Technical Guidance.

Baseline 2020 levels of NO_2 are predicted to comply with the annual mean limit value of 40 ug/m3 at all sensitive receptors considered within the study area. Some kerbside areas are predicted to exceed the annual mean limit value, but not any residential receptors. The predicted increase in the annual mean NO_2 as a consequence of the scheme is of Moderate Adverse significance at some receptors adjacent to local roads. Elsewhere the predicted impacts are of Slight Adverse significance or less in terms of the IAQM/EPUK assessment framework.

The baseline 2020 annual mean levels of PM_{10} are predicted to comply with the Scottish Air Quality Objective of 18 ug/m3 at all sensitive receptor locations within the study area. The predicted increase in PM_{10} exposure as a consequence of the scheme is of Slight Adverse significance at one receptor and of Negligible significance elsewhere in terms of the IAQM/EPUK assessment framework.

The predicted increase in $PM_{2.5}$ is of Negligible significance at all sensitive receptors within the study area in terms of the IAQM/EPUK assessment framework.

0582/P/21 - Land South of B7066 And West of A706 Heartlands, Whitburn, West Lothian

Planning permission in principle for a 78.4ha mixed-use development including residential, commercial land, community / education facilities, local services, open space, road infrastructure, engineering works and associated landscape proposals (EIA).

The air quality impact assessment for the development can be found at the following link;

https://planning.westlothian.gov.uk/publicaccess/files/DC221BB6319C6C0285A6428C320E56E9/pdf/0582_P_21-CH_10_-_AIR_QUALITY-3046571.pdf

The assessment concluded that in relation to NO_2 the impact of the proposed development is considered to be Negligible for all of the assessed sensitive receptors and therefore the resultant effects are not significant. The assessment concludes that in relation to PM_{10} the impact of the proposed development is considered to be Negligible for all of the assessed sensitive receptors and therefore the resultant effects are not significant. In relation to $PM_{2.5}$ the impact of the proposed development is considered to be Negligible for all of the assessed sensitive receptors and therefore the resultant effects are considered to be Not Significant.

0151/P/22 - Land to North and South of A705 Cousland Farm, Livingston, West Lothian

Planning permission in principle for a 24.9ha mixed use development for business (Class 4), industrial (Class 5) and storage and distribution (Class 6) with associated engineering, landscaping and drainage works.

Note - Planning permission was refused for this application, but it may come back in another year so it is worth noting.

6 Conclusions and Proposed Actions

6.1 Conclusions from New Monitoring Data

All long-term air quality objective levels were met in 2022 at all monitoring sites. There were 2 exceedances of the 24 hour mean PM_{10} value of 50µg/m^3 limit, at the Broxburn continuous monitoring site. However, the objective level is only breached when this is exceeded more than 7 times per year. It is noted that measured levels continued to be higher than levels detected during the COVID pandemic. There are now several years of data showing results below the air quality monitoring objectives. Updated detailed assessments for all three AQMA were produced during 2022. The updated detailed assessment for the Broxburn AQMA was considered, and work started in 2022 to revoke the AQMA for NO_2 and PM_{10}. Some poor data capture during 2022 has been frustrating and we again focused resources on dealing with equipment breakdowns and replacements. During 2022 a new Serinus NOx analyser was installed at our Newton site to try and ensure better data capture. In addition, the optics on the FIDAS units at Linlithgow and Broxburn were also replaced, again to try and ensure robust data capture at these sites. Following the review of our diffusion tube sites, results continue to be below objective levels.

6.2 Conclusions relating to New Local Developments

There have been no new local developments that have the potential to introduce new exceedances of relevant air quality objectives in West Lothian. The Local Development Plan for West Lothian identifies various residential sites in and around the AQMA's. It's likely that these will introduce further traffic related emissions and may be subject to Air Quality Impact Assessments (AQIA's), as and when they arise. These will be considered in line with our adopted Air Quality Supplementary Planning Guidance.

6.3 Proposed Actions

Monitoring data for 2022 has not highlighted any need for additional monitoring to take place. There are no new exceedances of the objective for any pollutant measured. Whilst measured levels increased in some cases during 2022, it can be shown that levels of pollutants in West Lothian have continued to be comfortably below air quality objective

limits for several years. Revocation of the Broxburn Air Quality Management Area will now progress. Resources will be focused on this during 2023 and will include public and stakeholder consultation periods. In addition, work will also take place on the review of the draft action plans for Linlithgow and Newton during 2023. An updated action plan for Broxburn will also remain in place following any revocation and this will be considered during 2023 as well.

In summary, the main priorities for 2023 are;

- Continue to focus resources on ensuring the continuous monitoring equipment is repaired and/or replaced where necessary and work towards a good data capture rate, with reliable, quality data. Continue to apply for funding to ensure maintenance of our continuous monitoring sites is prioritised;
- Carry out internal and public consultation on the proposed revocation of the Broxburn AQMA and work towards final agreement from Council committee;
- Continue to ensure that sufficient staff within Environmental Health are well trained and competent in local site operator duties;
- West Lothian Council will continue to apply to the Scottish Government for funding to assist with monitoring equipment and action plan measures;
- Begin a review into the Air Quality Action Plans for all three Air Quality Management Areas.

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? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
CM1	Linlithgow High St	Roadside	300426	677172	NO_2; PM_{10}; $PM_{2.5}$,	Y Linlithgow	FIDAS 200; T200 API NO_X Analyser	4	1.36	2.32
CM2	Broxburn CNC	Roadside	308314	672231	NO_2; PM_{10}; $PM_{2.5}$	Y Broxburn	FIDAS 200; T200 API NO_X Analyser	3.5	2.20	2.36
CM3	Newton CNC	Roadside	309258	677728	NO_2; PM_{10}: $PM_{2.5}$	Y Newton	FIDAS 200; Serinus 40 NO_X Analyser	1.8	1.92	2.41

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? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube co-located with a Continuous Analyser?	Tube Height (m)
DT1	Newton	Roadside	309223	677711	NO_2	Yes Newton	3	1.6	N	2.4
DT1N	Newton new site	Roadside	309187	677663	NO_2	Yes Newton	0.5	1.9	N	2.3
DT2	Broxburn WMS	Roadside	308165	672222	NO_2	Yes Broxburn	Façade	3.3	N	2.5
DT2N (3 co-located tubes)	Newton CNC	Roadside	309251	677723	NO_2	Yes Newton	1.9	1.9	Y	2.3
DT3	Broxburn EMS	Roadside	308426	672233	NO_2	Yes Broxburn	Façade	4	N	1.8
DT3N	Pumpherston Road, Uphall Station	Roadside	306061	670495	NO_2	No	1.2	1.8	N	2.4
DT4 (3 co-located tubes)	Broxburn CNC	Roadside	308314	672231	NO_2	Yes Broxburn	3.2	1.7	Y	2.5
DT5	Broxburn East Mains	Roadside	309368	672213	NO_2	Yes Broxburn	5	1.5	N	2.7
DT5N	Edinburgh Road, Broxburn	Roadside	308856	672226	NO_2	No	3.4	2.4	N	2.5
DT6	Cedric Rise, Dedridge	Urban background	306403	666341	NO_2	No	2.5	1.6	N	2.4
DT7	West Calder	Roadside	301758	663158	NO_2	No	2	2	N	2.5
DT7N	Alderstone Road, Livingston	Roadside	304630	666968	NO_2	No	4.5	1.7	N	2.4
DT8	Whitburn Partnership Centre	Roadside	294687	665030	NO_2	No	2	0.5	N	2.2

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) [1]	Distance to kerb of nearest road (m) [2]	Tube co-located with a Continuous Analyser?	Tube Height (m)
DT9	Armadale Cross	Roadside	293842	668588	NO_2	No	3	1.4	N	2.3
DT10	Bathgate South Bridge Street	Roadside	297401	668772	NO_2	No	1	1.5	N	2.1
DT10N	Armadale South Street	Roadside	293473	668944	NO_2	No	4.1	1.8	N	2.4
DT11	Bathgate Steelyard	Roadside	297467	668734	NO_2	No	Façade	2	N	2.5
DT12	Bathgate King St	Roadside	297570	668586	NO_2	No	5	4	N	2.5
DT13	Bathgate High St	Urban Background	297656	669298	NO_2	No	3	10	N	1.5
DT14 (3 co-located tubes)	Linlithgow CNC	Roadside	300412	677124	NO_2	Yes Linlithgow	4	1.36	Y	2.5
DT15	Linlithgow NW High St	Roadside	299930	677070	NO_2	Yes Linlithgow	2	1.4	N	2.4
DT16	Linlithgow SW High St	Roadside	299911	677052	NO_2	Yes Linlithgow	2	2.9	N	2.3
DT17	Linlithgow High St NE	Roadside	300479	677148	NO_2	Yes Linlithgow	3.4	2	N	1.5
DT17N	Hopetoun St, Bathgate	Roadside	297456	668937	NO_2	No	Façade	1.5	N	2.3
DT18	Linlithgow High St SE	Roadside	300485	677125	NO_2	Yes Linlithgow	7.5	1.5	N	2.6
DT18N	Polkemmet Rd, Whitburn	Roadside	293382	664399	NO_2	No		2.2	N	2.4
DT19	Linlithgow High St N	Roadside	300398	677132	NO_2	Yes Linlithgow	Façade	2.4	N	2.0
DT19N	Manse Road, Whitburn	Roadside	294668	664931	NO_2	No	6.2	1.7	N	2.4
DT20	Linlithgow High Street S(Old	Roadside	300405	677118	NO_2	Yes Linlithgow	Façade	3	N	2.7

Site ID	Site Name	Site Type	X OS Grid Ref	Y OS Grid Ref	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube co-located with a Continuous Analyser?	Tube Height (m)
	Post Office pub)									
DT21	Main St, East Calder	Roadside	308641	667912	NO_2	No	2.0	1.8	N	2.7
DT22	Butcher's, Winchburgh	Roadside	308957	675025	NO_2	No	Façade	1.8	N	2.5
DT23	Main St, Winchburgh	Roadside	309133	675028	NO_2	No	Façade	1.5	N	2.7
DT24N	Barber's, Linlithgow	Roadside	299957	677067	NO_2	No	Façade	2.8	N	2.4

Notes:

Shaded rows are included for reference – these diffusion tube locations have not been used since the review of the diffusion tubes took place at the end of 2021.

(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 ($\mu g/m^3$)

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CM1	Roadside	Automatic		95.7	28	30	16.4	19.6	17.3
CM2	Roadside	Automatic		94.4	27	27	19	22	21.4
CM3	Roadside	Automatic		48	17	18	12.6	15.7	12.7 (11.4)*
DT1N	Roadside	Diffusion Tube		91	-	-	-	-	11.0
DT2N**	Roadside	Diffusion Tube		100	-	-	-	-	14.1
DT3N	Roadside	Diffusion Tube		91	-	-	-	-	15.2
DT4**	Roadside	Diffusion Tube		91	28	27.2	15.5	25.6	22.7
DT5N	Roadside	Diffusion Tube		100	-	-	-	-	13.8
DT6	Urban background	Diffusion Tube		83	12.1	11.6	6.9	9.7	10
DT7N	Roadside	Diffusion Tube		100	-	-	-	-	12.1
DT8	Roadside	Diffusion Tube		100	20.5	23.8	14.9	21.7	18.8
DT9	Roadside	Diffusion Tube		91	23.1	24.2	12.6	20.4	18.2
DT10N	Roadside	Diffusion Tube		91	-	-	-	-	14.9
DT11	Roadside	Diffusion Tube		91	24.5	26.6	9.1	21.5	17.2
DT12	Roadside	Diffusion Tube		75	26.6	26.3	15.3	21.1	23.4
DT13	Roadside	Diffusion Tube		100	9.9	9.5	6.1	8.2	7.4
DT14**	Roadside	Diffusion Tube		100	26.9	25.3	13.9	19.3	18.5
DT15	Roadside	Diffusion Tube		100	24.7	24.6	11.8	18.4	17.3
DT16	Roadside	Diffusion Tube		91	29.2	29.4	13.8	21.3	20.8
DT17N	Roadside	Diffusion Tube		91	-	-	-	-	15.9
DT18N	Roadside	Diffusion Tube		100	-	-	-	-	8.4
DT19N	Roadside	Diffusion Tube		100	-	-	-	-	17

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
DT20	Roadside	Diffusion Tube		83	26.6	25.1	13.9	17.9	18.1
DT21	Roadside	Diffusion Tube		100	-	12.9	6.3	11.9	10.2
DT22	Roadside	Diffusion Tube		91	-	16.2	9.0	13.8	12
DT23	Roadside	Diffusion Tube		100	-	13.0	7.7	13.5	11.3
DT24N	Roadside	Diffusion Tube		25	-	-	-	-	17.8(12.8)*

***Annualised mean in brackets, data capture less than 75%**

****Results shown for these sites are averages of 3 co-located diffusion tubes. Please see Table B.1 for the results for each individual tube**

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**.

Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG(22) if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

(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%).

Table A.4 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site ID	Site Type	Monitoring Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CM1	Roadside	Automatic	N/A	95.7	0	**1**	0	0	0
CM2	Roadside	Automatic	N/A	94.4	0	0	0	0	0
CM3	Roadside	Automatic	N/A	48.0	0	0	0	0	0(51.1)

Notes:

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

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

(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%).

Table A.5 – Annual Mean PM_{10} Monitoring Results (µg/m^3)

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022	Factor applied to 2022 data (divide by 0.909)
CM1	Roadside		43%	11	12	8(7.7)	8.5	11.9	13.3(14.6)*
CM2	Roadside		91%	13	14	11	12	11.9	13.1
CM3	Roadside		40%	14	14	11(11.3)	11.3	8.2	9.4(11.3)*

***Annualised mean in brackets, data capture less than 75%**

Notes:

Exceedances of the PM_{10} annual mean objective of 18 µg/m^3 are shown in bold.

All means have been "annualised" as per LAQM.TG(22), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

(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%).

Table A.6 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50µg/m^3

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CM1	Roadside		43%	0	**5**	0	0	0 (26.9)
CM2	Roadside		91%	0	**4**	0	0	**2**
CM3	Roadside		40%	**1**	**2**	0	0	0 (18.9)

Notes:

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

If the period of valid data is less than 85%, the 98.1st percentile of 24-hour means is provided in brackets.

(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%).

Table A.7 – Annual Mean $PM_{2.5}$ Monitoring Results (µg/m^3)

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022	Factor applied to 2022 data (Multiply by 1.06)
CM1	Roadside		27%	6	7	5	5.4	6.5	7.1(7.8)*
CM2	Roadside		91%	7	8	6	6	6.3	6.7
CM3	Roadside		40%	n/a	10(9.4)	8	7.3	4.6	4.9(6.5)*

***Annualised mean in brackets, data capture less than 75%**

Notes:

Exceedances of the $PM_{2.5}$ annual mean objective of 10 µg/m^3 are shown in bold.

All means have been "annualised" as per LAQM.TG(22), valid data capture for the full calendar year is less than 75%. See Appendix C for details.

(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%).

Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Monthly Diffusion Tube Results (µg/m^3)

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Local Bias Adjusted (1) 0.69	National Bias Adjusted 0.76	Data Capture %
DT1N	No data	15.5	18.4	14.8	11.6	10.9	12.4	13.5	14.6	11.6	17.6	18.6	**14.5**	10	11.0	91
DT2N (Overall average)	19.4	18.4	24.5	16.9	16.3	14.6	13.2	18.1	18.5	16.0	23.4	24.0	**18.6**	12.8	14.1	100
DT2N – Tube 1	20.6	19.0	26.5	16.3	16.4	14.6	13.0	17.3	18.2	16.4	18.2	24.5	**18.4**	12.7	14.0	100
DT2N – Tube 2	19.4	18.9	22.8	17.7	15.9	15.2	13.6	19.5	18.5	16.9	26.0	24.2	**19.1**	13.2	14.5	100
DT2N – Tube 3	18.3	17.4	24.1	16.7	16.6	14.1	13.2	17.5	18.8	14.8	26.1	23.3	**18.4**	12.7	14.0	100
DT3N	No data	14.3	30.0	23.9	16.1	12.8	15.8	18.7	22.3	17.0	21.7	26.9	**20.0**	13.8	15.2	91
DT4 (Overall average)	33.6	28.9	38.8	34.5	18.3	19.5	23.2	29.3	33.4	No data	28.5	40.0	**29.8**	20.6	22.7	91
DT4 – Tube 1	35.2	26.5	38.1	33.2	14.8	19.4	22.1	30.2	33.2	No data	27.7	39.5	**29.1**	20.0	22.1	91
DT4 – Tube 2	32.3	31.2	39.5	35.6	14.2	20.2	23.3	28.4	34.1	No data	32.9	41.5	**30.3**	20.9	23.0	91

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Local Bias Adjusted (1) 0.69	National Bias Adjusted 0.76	Data Capture %
DT4 – Tube 3	33.3	29.1	38.7	34.7	26.0	18.9	24.1	29.2	33.1	No data	25.0	39.0	**30.1**	20.9	15.9	91
DT5N	21.1	17.4	29.9	18.7	13.2	12.0	12.8	17.5	19.8	17.5	8.2	28.8	**18.1**	12.5	13.8	100
DT6	13.2	11.1	18.7	10.9	9.2	7.0	No data	No data	12.4	10.5	16.5	21.1	**13.1**	9	10	83
DT7N	17.7	13.4	25.7	17.0	14.5	10.2	6.6	15.3	17.9	16.0	11.3	24.9	**15.9**	11	12.1	100
DT8	26.2	21.1	30.0	28.2	22.2	17.6	21.2	21.5	27.4	20.5	27.1	33.9	**24.7**	17	18.8	100
DT9	34.8	30.6	30.0	19.4	9.3	No data	21.0	20.4	19.4	23.8	26.3	28.9	**24.0**	16.6	18.2	91
DT10N	No data	18.3	30.4	21.1	13.8	13.6	16.0	17.0	20.5	18.3	18.3	28.3	**19.6**	13.5	14.9	91
DT11	29.9	25.1	No data	23.4	9.8	18.1	19.7	22.3	25.5	22.7	10.6	42.0	**22.6**	15.6	17.2	91
DT12	No data	No data	42.7	24.6	No data	19.9	22.9	26.1	29.6	29.1	36.9	45.4	**30.8**	21.3	23.4	75
DT13	13.1	9.6	15.2	9.2	6.1	5.5	5.4	6.8	7.7	7.3	12.8	17.2	**9.7**	6.7	7.4	100
DT14 (Overall average)	28.0	25.3	34.2	22.9	17.8	17.5	17.6	21.9	23.1	22.0	27.2	34.2	**24.3**	16.8	18.5	100
DT14 - Tube 1	30.2	27.9	34.4	21.8	18.5	17.7	16.9	21.5	23.1	23.2	27.3	34.5	**24.8**	17.1	18.8	100

Site ID	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Local Bias Adjusted (1) 0.69	National Bias Adjusted 0.76	Data Capture %
DT14 – Tube 2	28.1	24.1	33.0	23.0	18.8	17.3	17.8	20.9	23.6	22.9	22.2	34.3	**23.8**	16.4	18.1	91
DT14 – Tube 3	25.8	23.9	35.1	24.0	19.2	17.4	18.2	23.4	22.6	19.9	32.2	33.8	**24.6**	17.0	18.7	91
DT15	23.6	20.3	35.0	26.2	17.3	14.1	17.5	21.1	25.0	18.1	23.3	30.6	**22.7**	15.7	17.3	100
DT16	30.7	26.5	33.3	27.3	No data	20.7	19.9	25.2	27.0	23.5	30.7	36.5	**27.4**	18.9	20.8	91
DT17N	23.7	21.6	29.5	19.7	16.5	13.7	16.2	18.2	20.8	No data	15.7	34.1	**20.9**	14.4	15.9	91
DT18N	No data	7.0	15.5	11.4	9.4	7.2	9.3	10.1	13.6	7.8	12.5	17.6	**11.0**	7.6	8.4	100
DT19N	25.6	19.7	31.8	23.4	18.3	15.6	16.6	19.2	22.5	19.6	23.1	32.2	**22.3**	15.4	17	100
DT20	No data	No data	33.6	22.2	18.1	17.7	17.7	21.8	21.8	21.0	29.5	34.3	**23.8**	16.4	18.1	83
DT21	14.3	12.0	18.2	11.7	10.7	9.1	9.8	11.5	14.0	12.1	17.7	19.3	**13.4**	9.3	10.2	100
DT22	No data	13.2	23.6	13.1	11.9	11.1	11.8	14.4	13.5	15.9	22.1	23.1	**15.8**	10.9	12.0	91
DT23	15.0	13.4	22.9	17.3	9.9	9.4	11.4	12.8	16.3	12.2	13.2	24.3	**14.8**	10.2	11.3	100
DT24N										21.7	14.6	33.8	**23.4 (16.9)***	16.2(11.7)*	17.8(12.8)*	25

(1) Shown for reference only

* annualised figure shown in brackets – annualization carried out due to only having 25% data. See Appendix C for details of annualisation

Table B.2 – Historical Monthly Diffusion Tube Results

SITE ID	2018 Raw data	2018 Bias adjusted	2019 Annual	2019 Bias adjusted	2020 Annual	2020 Bias adjusted	2021 Annual	2021 Bias	2022 Annual Raw data	2022 Bias adjusted
DT1	26.4	21.1	26.9	20.7	12.8	8.7	19.2	14.9	Site no longer in use	-
DT1N*	-	-	-	-	-	-	-	-	14.5	11.0
DT2	33.1	26.5	30.1	23.2	18.1	12.3	26.7	20.8	Site no longer in use	-
DT2N*	-	-	-	-	-	-	-	-	18.6	14.1
DT3	27.7	22.2	28.8	22.2	17.1	11.6	25.6	19.9	Site no longer in use	-
DT3N*	-	-	-	-	-	-	-	-	20.0	15.2
DT4	35.0	28.0	35.3	27.2	22.8	15.5	32.8	25.6	29.8	22.7
DT5	28.1	22.5	29.4	22.6	19.9	13.5	27.9	21.8	Site no longer in use	-
DT5N*	-	-	-	-	-	-	-	-	18.1	13.8
DT6	15.1	12.1	15.1	11.6	10.1	6.9	12.4	9.7	13.1	10

DT7	25.9	20.7	27	20.8	16.8	11.4	21.9	17.1	Site no longer in use	-
DT7N*	-	-	-	-	-	-	-	-	15.9	12.1
DT8	24.6	23.9	25.6	20.5	30.9	23.8	21.9	14.9	24.7	18.8
DT9	26	25.2	28.9	23.1	31.4	24.2	18.5	12.6	24.0	18.2
DT10	19.5	18.9	20.5	16.4	21.8	16.8	12.7	8.6	Site no longer in use	-
DT10N*	-	-	-	-	-	-	-	-	19.6	14.9
DT11	28.9	28.0	30.6	24.5	34.5	26.6	13.4	9.1	22.6	17.2
DT12	28	27.2	33.2	26.6	34.2	26.3	22.5	15.3	30.8	23.4
DT13	11	10.7	12.4	9.9	12.3	9.5	8.9	6.1	9.7	7.4
DT14	23.3	31.6	33.6	26.9	32.8	25.3	20.4	13.9	24.3	18.5
DT15	26.2	28.1	30.9	24.7	32	24.6	17.3	11.8	22.7	17.3
DT16	25.5	33.9	36.5	29.2	38.2	29.4	20.3	13.8	27.4	20.8
DT17	28.4	25.7	27.2	21.8	25.9	26.7	14.5	9.9	Site no longer in use	-

DT17N*	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	**20.9**	15.9
DT18	**26.7**	**30.6**	**31.7**	**25.4**	**28.6**	**22**	**16.9**	**11.5**	**Site no longer in use**	-
DT18N*	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**11.0**	8.4
DT19	**12.1**	**26.5**	**28.4**	**22.7**	**29.1**	**22.4**	**13.1**	**8.9**	**Site no longer in use**	-
DT19N*	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	**22.3**	17
DT20	**22.1**	**30.8**	**33.3**	**26.6**	**32.6**	**25.1**	**20.4**	**13.9**	**23.8**	18.1
DT21	**N/A**	**N/A**	**N/A**	**N/A**	**16.7**	**12.9**	**9.3**	**6.3**	**13.4**	10.2
DT22	**N/A**	**N/A**	**N/A**	**N/A**	**21.1**	**16.2**	**13.3**	**9.0**	**15.8**	12
DT23	**N/A**	**N/A**	**16.9**	**13.0**	**11.3**	**7.7**	**17.3**	**13.5**	**14.8**	11.3
DT24N**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**23.4(16.9)*****	17.8(12.8)***

* New site added in January 2022

** New site added in October 2022

*** Annualised data in brackets – due to low data capture

NB: DT2N, DT4 and DT 14 sites all have 3 tubes co-located with the continuous monitors.

Notes:

(1) See Appendix C for details on bias adjustment

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

New or Changed Sources Identified Within West Lothian Council During 2022

As noted in Section 4.3 of this report, West Lothian Council obtained information from SEPA regarding any new or altered authorised processes that could impact on air quality within the Council area. The following processes were highlighted as new/varied potential sources during 2022;

Authorisation Number	Authorisation Level	Site Address	Authorisation Holder	Authorisation Activity	Application Type
PPC/B/5002446	PPC Part B	Livingston Service Station, Almondvale South, Livingston, EH54 6FX	Euro Garages Ltd	PPC(B) - Petrol Vapour Recovery	New Licence
PPC/B/1000036	PPC Part B	Nettlehill Road, Houston Industrial Estate, Livingston, EH54 5DL	Elementis UK Limited	PPC(B) - Organic Chemicals	Operator Technical (Substantial) Variation to existing Authorisation
PPC/B/5003180	PPC Part B	GNNR. Gas Peaking Project, 3 Nairn Road, Deans Industrial Estate,	Greenspan Nifty Fifty Limited	PPC(B) - Combustion of Fuels	New Licence

		Deans, Livingston, EH54 8AY			
PPC/B/5002633	PPC Part B	2 Simpson Parkway, Kirkton Campus, Livingston, West Lothian, EH54 7BH	Cazoo Ltd	PPC(B) - Coating & Printing and Textile Treatments	New Licence
WML/L/5001918	WML	Unit 51, Burnhouse Industrial Estate, Whitburn, EH47 0LQ	Erith Contractors Limited		New Licence

Additional Air Quality Works Undertaken by West Lothian Council During 2022

West Lothian Council arranged for the update of the detailed assessment for all 3 Air Quality management Areas during 2022. Work also started on the revocation of the Broxburn AQMA and consultation with the public and internal/external stakeholders will take place during 2023. The Air Quality Action Plans for all 3 sites will also be looked at with a view to updating these at the end of 2023 or beginning of 2024. Links to the updated detailed assessments can be found in the reference section at the end of this report.

QA/QC of Diffusion Tube Monitoring

- The supplier used for diffusion tubes within 2022 in West Lothian was SOCOTEC and the method of preparation that was used was by spiking Acetone: Triethanolamine (50:50) onto the grids prior to the tubes being assembled. The tubes were desorbed with distilled water and the extract analysed using a segmented flow

auto analyser with ultraviolet detection. The lab used for analysis was SOCOTEC Didcot.

- The samples have been analysed in accordance with SOCOTEC's standard operating procedure ANU/SOP/1015. This method meets the guidelines set out in DEFRA's 'Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance. As set out in the practical guidance, the results were initially calculated assuming an ambient temperature of 11^{o}C, the reported values have been adjusted to 20^{o}C to allow for direct comparison with EU limits. This analysis of diffusion tube samples to determine the amount of nitrogen dioxide present on the tube is within the scope of our UKAS schedule. Any further calculations and assessments requiring exposure details and conditions fall outside the scope of our accreditation. In the AIR PT inter comparison scheme for comparing spiked Nitrogen Dioxide diffusion tubes, SOCOTEC currently holds the highest rank of a Satisfactory laboratory.
- The same diffusion tube supplier was used in West Lothian throughout 2022.
- West Lothian Council changed the diffusion tubes in accordance with the LAQM Nitrogen Dioxide Diffusion tube monitoring calendar throughout 2022.

Diffusion Tube Annualisation

Only one diffusion tube within West Lothian Council required annualization – DT24N. This tube was installed in late September 2022 and therefore only had 3 months (25%) of data capture available. The Bureau Veritas Diffusion Tube Data Processing Tool Version 3 was utilised to calculate an annualization factor for this tube. In line with the guidance in LAQM.TG(22), Glasgow Townhead and Edinburgh Currie sites were used as they are both background sites, as opposed to the ones in our own area which are roadside sites. The continuous monitoring data from these sites was input into the spreadsheet and the annualization factor for DT24N was produced – see details below;

Table C.1 – Diffusion Tube Annualisation Summary (concentrations in µg/m^3)

Annualisation Factor Glasgow Townhead	Annualisation Factor Edinburgh Currie	Average Annualisation Factor	Raw Data Simple Annual Mean (µg/m^3)	Annualised Data Simple Annual Mean (µg/m^3)
0.7424	0.7071	0.7248	23.4	16.9

Diffusion Tube Bias Adjustment Factors

West Lothian Council calculated both a national and local bias adjustment factor of 0.76 (national) and 0.69 (local) for 2022, for comparison. A summary of bias adjustment factors applied over the past 5 years is presented in Table C.2. The data provided in Table A.3 has the national bias adjustment factor applied. It was decided to select the national bias adjustment factor for 2022, for a number of reasons;

- Diffusion tubes are changed monthly, had they been changed more frequently, this would have favoured use of the local bias adjustment factor;
- There are no unusual situations within our co-location sites;
- The diffusion tube study was not less than 12 months;
- Data capture at one of our co-location sites (Newton) using the automatic monitor was poor for NO_2.

Table C.2 – Bias Adjustment Factor

Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	Local	-	0.69
2022	National	03/23 (4 studies applicable to this factor)	0.76
2021	National	03/22	0.78
2020	Local	-	0.68
2019	Local	-	0.77
2018	Local	-	0.8

Table C.3 – Local Bias Correction Factor Summary

	Local Bias Adjustment Linlithgow	Local Bias Adjustment Broxburn	Local Bias Adjustment Newton
Periods used to calculate bias	11	9	6
Bias Factor A	0.71	0.72	0.63
Bias Factor B	40%	38%	59%

	Local Bias Adjustment Linlithgow	Local Bias Adjustment Broxburn	Local Bias Adjustment Newton
Diffusion Tube Mean (µg/m^3)	25	31	19
Mean CV (Precision)	6	5	7
Automatic Mean (µg/m^3)	18	23	12
Data Capture	99	99	92
Adjusted Tube Mean (µg/m^3)	17	22	12

Table C.4 – Local Bias Correction Factor Calculation

Automatic Roadside Monitoring Site	Bias B%
Linlithgow	40
Broxburn	38
Newton	59
Mean Bias B	45
Factor + 1	1.45
Inverse	**0.69***

***As per paragraph 7.222 in LAQM-TG22, as there was more than one local co-location study, the B values have been averaged (45), the resultant figure expressed as a factor (1.45) and the inverse of this factor taken i.e. 1/1.45 = 0.69.**

NO_2 Fall-off with Distance from the Road

No diffusion tube NO_2 monitoring locations within West Lothian Council required distance correction during 2022.

QA/QC of Automatic Monitoring

- The data management and LSO duties are carried out by Technical Officer Sarah Gillespie at West Lothian Council. LSO duties are also carried out by Technical Officers Andrew Kerr & Lorraine McMurray.
- Manual Calibrations are now carried out fortnightly on the NO_X analysers at each of the three automatic monitoring stations. These are carried out by both Technical Officers and Environmental Health Officers in the Public Health Team. Audits are carried out every 6 months by Ricardo AEA Technology and servicing is also carried out every 6 months by an engineer from Enviro Technology.
- Ratification of the data is carried out by Ricardo AEA, and the monitoring data presented within the APR is ratified;
- Live and historic data is currently available on the Scottish Air quality web-site. This is available at www.scottishairquality.scot.

PM_{10} and $PM_{2.5}$ Monitoring Adjustment

Guidance was issued in May 2023 from the Scottish Government regarding the application of a factor to PM_{10} and $PM_{2.5}$ data produced from a FIDAS analyser. The correction factors specified in this guidance, have been applied to the data obtained from the FIDAS analysers in West Lothian and the results are detailed in this report.

Automatic Monitoring Annualisation

Annualisation was required for two of our automatic monitoring sites in West Lothian located at Linlithgow and Newton. Annualisation was required for PM_{10}, $PM_{2.5}$ and NO_2 for Newton and PM_{10} and $PM_{2.5}$ for Linlithgow as the data capture was less than 75%. The results are shown in Table C.5.

NO_2 Fall-off with Distance from the Road

No automatic NO_2 monitoring locations within West Lothian Council required distance correction during 2022.

Table C.5 – Annualisation Summary (concentrations presented in µg/m3)

Site ID	Annualisation Factor Glasgow Townhead	Annualisation Factor Edinburgh Currie	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
Linlithgow CM1 (PM_{10})	1.0	1.2	1.1	13.3	14.6	
Linlithgow CM1 ($PM_{2.5}$)	1.0	1.2	1.1	7.1	7.8	
Newton CM3 (NO_2)	0.9	0.9	0.9	12.66	11.4	
Newton CM3 (PM_{10})	1.2	1.2	1.2	9.4	11.3	
Newton CM3 ($PM_{2.5}$)	1.23	1.3	1.3	4.9	6.5	
DT24N	0.7424	0.7071	0.7248	23.4	16.9	Bureau Veritas Diffusion Tube Tool V3 utilised

As described in the Technical Guidance LAQM-TG-16, annualisation is carried out when data capture is less than 75%. In order to do this, two to four nearby, long-term, continuous monitoring sites, ideally those forming part of the national network require to be identified. The data capture for each of these sites should ideally be at least 85%. These sites should be background (Urban Background, Suburban or Rural) sites to avoid any localised effects that may occur at Urban Centre, Roadside or Kerbside sites, and should, wherever possible lie within a radius of about 50 miles. If no background sites are available, and the site to be annualised is itself an Urban Centre, Roadside or Kerbside site, then it is permissible to annualise using roadside or kerbside sites rather than background sites, though this should be clearly stated in the annual report.

The next step is to obtain the annual means, **Am**, for the calendar year for these sites. Then work out the period means, **Pm**, for the period of interest (i.e. the period when data capture was poor at your own site), then calculate the ratio, **R**, of the annual mean to the period mean (**Am/Pm**) for each of the sites. Finally, calculate the average of these ratios, **Ra**. This is then the annualisation factor.

The next stage is to multiply the measured period mean concentration **M** by this annualisation factor **Ra** to give the estimate of the annualisation for 2021.

- The period mean for Linlithgow (CM1) for PM_{10} was January to February and October to December 2022, for $PM_{2.5}$ it was October to December 2022. – awaiting info from RICARDO re low data capture months
- The period mean for Newton (CM3) for PM_{10} and $PM_{2.5}$ was July to November 2022. The period mean for NO_2 for Newton was August to December 2022.
- In order to comply with the guidance in LAQM TG 22, the two sites used to calculate annualization for Linlithgow and Newton were Glasgow (Townhead) and Edinburgh Currie. Glasgow Townhead is an urban background site and Edinburgh Currie is a suburban site. Both sites had more that 85% data collection and lie within a 50 mile radius of the West Lothian sites.

Annualisation was required for one diffusion tube – DT24N – this was because the tube was installed in late September 2022, so there was only 25% data capture. Version 3 of the Diffusion Tube Data Processing Tool was utilised to calculate the average annualization

factor for this tube. As for the automatic monitor annualization, Glasgow Townhead and Edinburgh Currie sites were utilised as background sites.

A local adjustment factor was calculated using data input into the AEA Diffusion Tube Precision Accuracy Bias spreadsheet. See screenshots of the output from this spreadsheet in Figures 1 to 3. A national bias adjustment factor was obtained from the National Diffusion Tube Bias Adjustment Factor Spreadsheet – see screenshot in Figure 4.

Figure 1 – Screenshot from AEA Spreadsheet - Bias Adjustment Factors for Diffusion Tubes - Linlithgow AQ Station

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	05/01/2022	02/02/2022	30.2	28.1	25.8	28	2.2	8	5.5	20.5	100	Good	Good
2	02/02/2022	01/03/2022	27.9	24.1	23.9	25	2.3	9	5.6	19.5	100	Good	Good
3	01/03/2022	29/03/2022	34.4	33.0	35.1	34	1.1	3	2.7	28.4	99	Good	Good
4	29/03/2022	05/05/2022	21.8	23.0	24.0	23	1.1	5	2.7	19.4	99	Good	Good
5	05/05/2022	07/06/2022	18.5	18.8	19.2	19	0.4	2	0.9	13	98	Good	Good
6	07/06/2022	06/07/2022	17.7	17.3	17.4	17	0.2	1	0.5	12	98	Good	Good
7	06/07/2022	02/08/2022	16.9	17.8	18.2	18	0.7	4	1.7	12	99	Good	Good
8	02/08/2022	30/08/2022	21.5	20.9	23.4	22	1.3	6	3.2	13	65	Good	or Data Capture
9	30/08/2022	27/09/2022	23.1	23.6	22.6	23	0.5	2	1.2	15	98	Good	Good
10	27/09/2022	01/11/2022	23.2	22.9	19.9	22	1.8	8	4.5	14	98	Good	Good
11	01/11/2022	02/12/2022	27.3	22.2	32.2	27	5.0	18	12.4	17.3	97	Good	Good
12	02/12/2022	04/01/2023	34.5	34.3	33.8	34	0.4	1	0.9	21.7	98	Good	Good
13													
											Overall survey -->	Good precision	Good Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

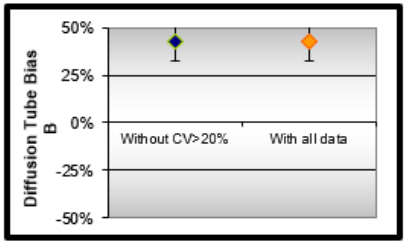
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Linlithgow CNC

Precision: 12 out of 12 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 11 periods of data	
Bias factor A	0.71 (0.66 - 0.77)
Bias B	40% (30% - 51%)
Diffusion Tubes Mean:	25 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	18 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	17 (16 - 19) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 11 periods of data	
Bias factor A	0.71 (0.66 - 0.77)
Bias B	40% (30% - 51%)
Diffusion Tubes Mean:	25 μgm^{-3}
Mean CV (Precision):	6
Automatic Mean:	18 μgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	17 (16 - 19) μgm^{-3}



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Version 04 - February 2011

Figure 2 – Screenshot from AEA Spreadsheet - Bias Adjustment Factors for Diffusion Tubes - Broxburn AQ Station

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 µgm^{-3}	Tube 2 µgm^{-3}	Tube 3 µgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	05/01/2022	02/02/2022	35.2	32.3	33.3	34	1.5	4	3.7	22	100	Good	Good
2	02/02/2022	01/03/2022	26.5	31.2	29.1	29	2.4	8	5.8	19	100	Good	Good
3	01/03/2022	29/03/2022	38.1	39.5	38.7	39	0.7	2	1.7	32	99	Good	Good
4	29/03/2022	05/05/2022	33.2	35.6	34.7	35	1.2	4	3.0	20	98	Good	Good
5	05/05/2022	07/06/2022	14.8	14.2	26.0	18	6.6	36	16.5	15	85	Poor Precision	Good
6	07/06/2022	06/07/2022	19.4	20.2	18.9	20	0.7	3	1.6	14	98	Good	Good
7	06/07/2022	02/08/2022	22.1	23.3	24.1	23	1.0	4	2.5	16	98	Good	Good
8	02/08/2022	30/08/2022	30.2	28.4	29.2	29	0.9	3	2.2	19	62	Good	or Data Capture
9	30/08/2022	27/09/2022	33.2	34.1	33.1	33	0.6	2	1.4	23	98	Good	Good
10	27/09/2022	01/11/2022	No data	No data	No data					17	98		Good
11	01/11/2022	02/12/2022	27.7	32.9	25.0	29	4.0	14	10.0	24	98	Good	Good
12	02/12/2022	04/01/2023	39.5	41.5	39.0	40	1.3	3	3.3	33	99	Good	Good
13													
										Overall survey -->		Good precision	Good Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

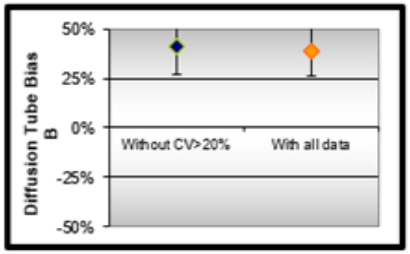
(Check average CV & DC from Accuracy calculations)

Site Name/ ID:	Broxburn CNC

Precision: 10 out of 11 periods have a CV smaller than 20%

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 9 periods of data	
Bias factor A	0.72 (0.66 - 0.8)
Bias B	38% (24% - 52%)
Diffusion Tubes Mean:	31 µgm^{-3}
Mean CV (Precision):	5
Automatic Mean:	23 µgm^{-3}
Data Capture for periods used:	99%
Adjusted Tubes Mean:	22 (21 - 25) µgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 10 periods of data	
Bias factor A	0.73 (0.67 - 0.8)
Bias B	37% (24% - 50%)
Diffusion Tubes Mean:	30 µgm^{-3}
Mean CV (Precision):	8
Automatic Mean:	22 µgm^{-3}
Data Capture for periods used:	97%
Adjusted Tubes Mean:	22 (20 - 24) µgm^{-3}



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Version 04 - February 2011

Figure 3 – Screenshot from AEA Spreadsheet - Bias Adjustment Factors for Diffusion Tubes - Newton AQ Station

Checking Precision and Accuracy of Triplicate Tubes

AEA Energy & Environment
From the AEA group

Diffusion Tubes Measurements										Automatic Method		Data Quality Check	
Period	Start Date dd/mm/yyyy	End Date dd/mm/yyyy	Tube 1 μgm^{-3}	Tube 2 μgm^{-3}	Tube 3 μgm^{-3}	Triplicate Mean	Standard Deviation	Coefficient of Variation (CV)	95% CI of mean	Period Mean	Data Capture (% DC)	Tubes Precision Check	Automatic Monitor Data
1	05/01/2022	02/02/2022	20.6	19.4	18.3	19	1.2	6	2.9	10.4	24	Good	or Data Capture
2	02/02/2022	01/03/2022	19.0	18.9	17.4	18	0.9	5	2.2	No data		Good	
3	01/03/2022	29/03/2022	26.5	22.8	24.1	24	1.9	8	4.7	No data		Good	
4	29/03/2022	05/05/2022	16.3	17.7	16.7	17	0.7	4	1.8	No data		Good	
5	05/05/2022	07/06/2022	16.4	15.9	16.6	16	0.4	2	0.9	No data		Good	
6	07/06/2022	06/07/2022	14.6	15.2	14.1	15	0.6	4	1.4	No data		Good	
7	06/07/2022	02/08/2022	13.0	13.6	13.2	13	0.3	2	0.8	10	78	Good	Good
8	02/08/2022	30/08/2022	17.3	19.5	17.5	18	1.2	7	3.0	10	94	Good	Good
9	30/08/2022	27/09/2022	18.2	18.5	18.8	19	0.3	2	0.7	11	96	Good	Good
10	27/09/2022	01/11/2022	16.4	16.9	14.8	16	1.1	7	2.7	11	89	Good	Good
11	01/11/2022	02/12/2022	18.2	26.0	26.1	23	4.5	19	11.3	15	96	Good	Good
12	02/12/2022	04/01/2023	24.5	24.2	23.3	24	0.6	3	1.6	15	96	Good	Good
13													
											Overall survey -->	Good precision	Poor Overall DC

It is necessary to have results for at least two tubes in order to calculate the precision of the measurements

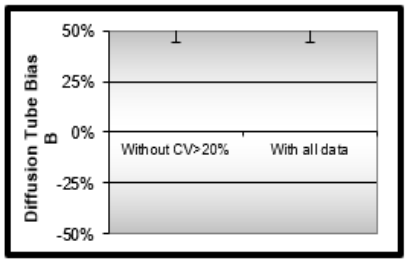
Site Name/ ID:	Newton CNC

Precision: 12 out of 12 periods have a CV smaller than 20%

(Check average CV & DC from Accuracy calculations)

Accuracy (with 95% confidence interval) without periods with CV larger than 20%	
Bias calculated using 6 periods of data	
Bias factor A	0.63 (0.58 - 0.69)
Bias B	59% (44% - 73%)
Diffusion Tubes Mean:	19 μgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	12 μgm^{-3}
Data Capture for periods used:	92%
Adjusted Tubes Mean:	12 (11 - 13) μgm^{-3}

Accuracy (with 95% confidence interval) WITH ALL DATA	
Bias calculated using 6 periods of data	
Bias factor A	0.63 (0.58 - 0.69)
Bias B	59% (44% - 73%)
Diffusion Tubes Mean:	19 μgm^{-3}
Mean CV (Precision):	7
Automatic Mean:	12 μgm^{-3}
Data Capture for periods used:	92%
Adjusted Tubes Mean:	12 (11 - 13) μgm^{-3}



Jaume Targa, for AEA
Version 04 - February 2011

Figure 4 – Screenshot of National Diffusion Tube Bias Adjustment Factors Spreadsheet (DEFRA)

National Diffusion Tube Bias Adjustment Factor Spreadsheet

Spreadsheet Version Number: 03/23

Follow the steps below in the correct order to show the results of relevant co-location studies

Data only apply to tubes exposed monthly and are not suitable for correcting individual short-term monitoring periods

Whenever presenting adjusted data, you should state the adjustment factor used and the version of the spreadsheet

This spreadhseet will be updated every few months: the factors may therefore be subject to change. This should not discourage their immediate use.

This spreadsheet will be updated at the end of June 2023

LAQM Helpdesk Website

The LAQM Helpdesk is operated on behalf of Defra and the Devolved Administrations by Bureau Veritas, in conjunction with contract partners AECOM and the National Physical Laboratory.

Spreadsheet maintained by the National Physical Laboratory. Original compiled by Air Quality Consultants Ltd.

Step 1:	Step 2:	Step 3:	Step 4:
Select the Laboratory that Analyses Your Tubes from the Drop-Down List	Select a Preparation Method from the Drop-Down List	Select a Year from the Drop-Down List	Where there is only one study for a chosen combination, you should use the adjustment factor shown with caution. Where there is more than one study, use the overall factor[3] shown in blue at the foot of the final column.
If a laboratory is not shown, we have no data for this laboratory.	If a preparation method is not shown, we have no data for this method at this laboratory.	If a year is not shown, we have no data[2]	If you have your own co-location study then see footnote[4]. If uncertain what to do then contact the Local Air Quality Management Helpdesk at LAQMHelpdesk@bureauveritas.com or 0800 0327953

Analysed By[1]	Method (To undo your selection, choose (All) from the pop-up list)	Year[5] (To undo your selection, choose (All))	Site Type	Local Authority	Length of Study (months)	Diffusion Tube Mean Conc. (Dm) (µg/m^3)	Automatic Monitor Mean Conc. (Cm) (µg/m^3)	Bias (B)	Tube Precision[6]	Bias Adjustment Factor (A) (Cm/Dm)
SOCOTEC Didcot	50% TEA in acetone	2022	R	Leeds City Council	11	41	30	34.2%	G	0.75
SOCOTEC Didcot	50% TEA in acetone	2022	R	Leeds City Council	12	30	22	36.9%	G	0.73
SOCOTEC Didcot	50% TEA in acetone	2022	UC	Leeds City Council	12	30	22	34.1%	G	0.75
SOCOTEC Didcot	50% TEA in Acetone	2022	R	Thanet District Council	12	23	17	29.1%	G	0.77
SOCOTEC Didcot	50% TEA in acetone	2022		Overall Factor[3] (26 studies)				Use		0.76

Figure 5 – Pollutant trend graphs over the past 5 years – PM_{10} trend graph - 2018 to 2022

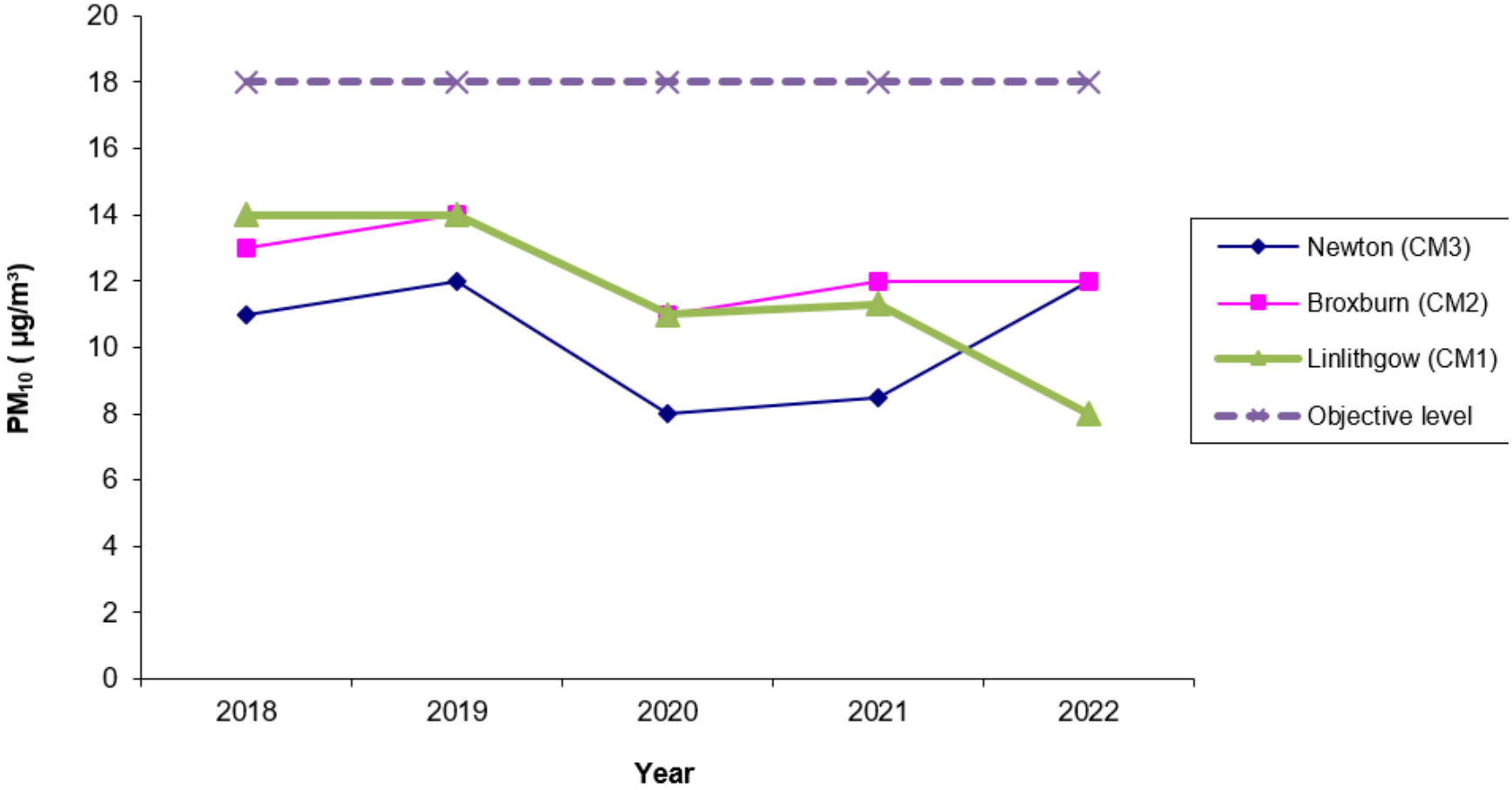


Figure 6 – Pollutant trend graphs over the past 5 years – $PM_{2.5}$ trend graph - 2018 to 2022

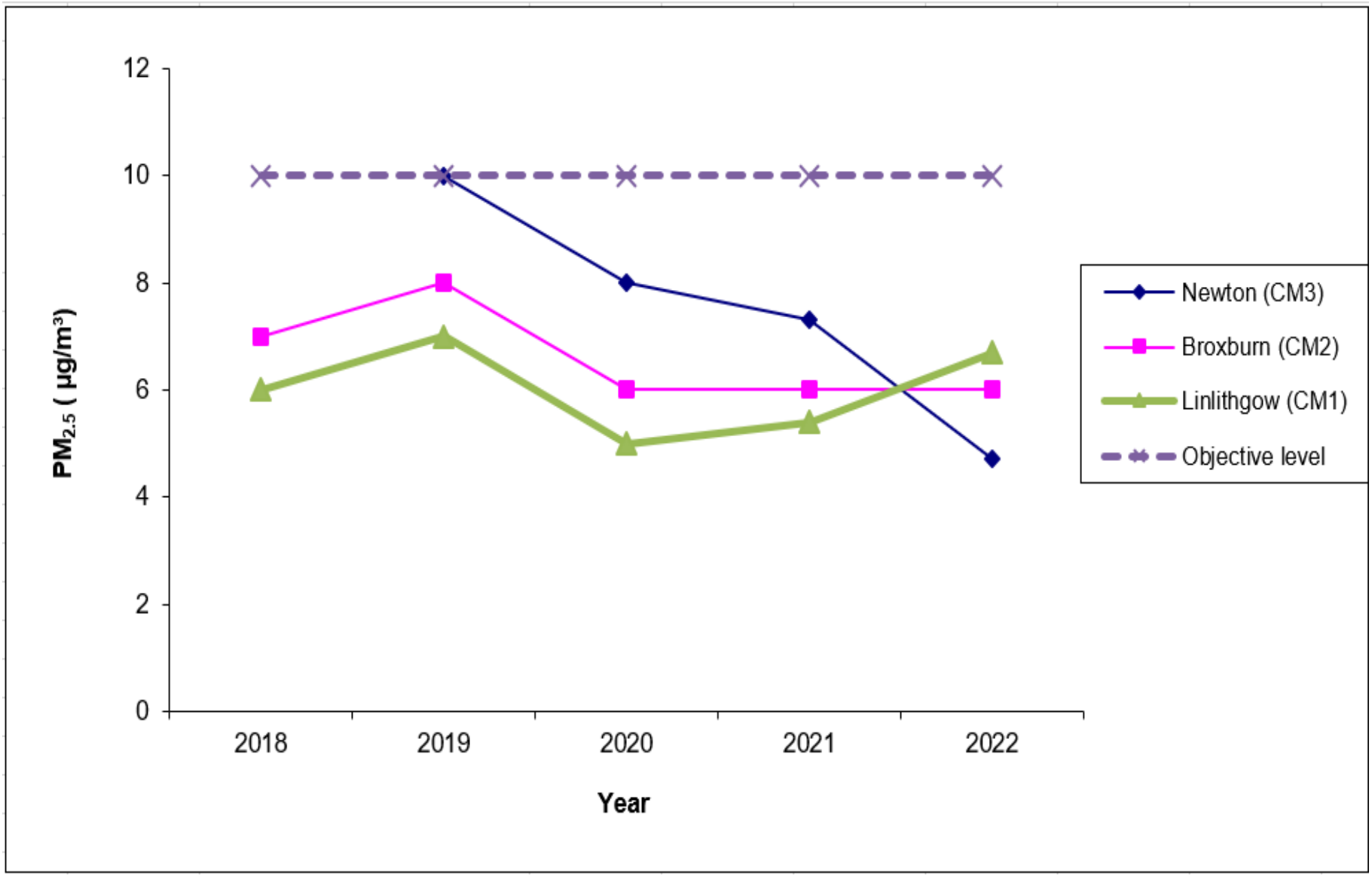


Figure 7 – Pollutant trend graphs over the past 5 years – NO2 trend graph - 2018 to 2022

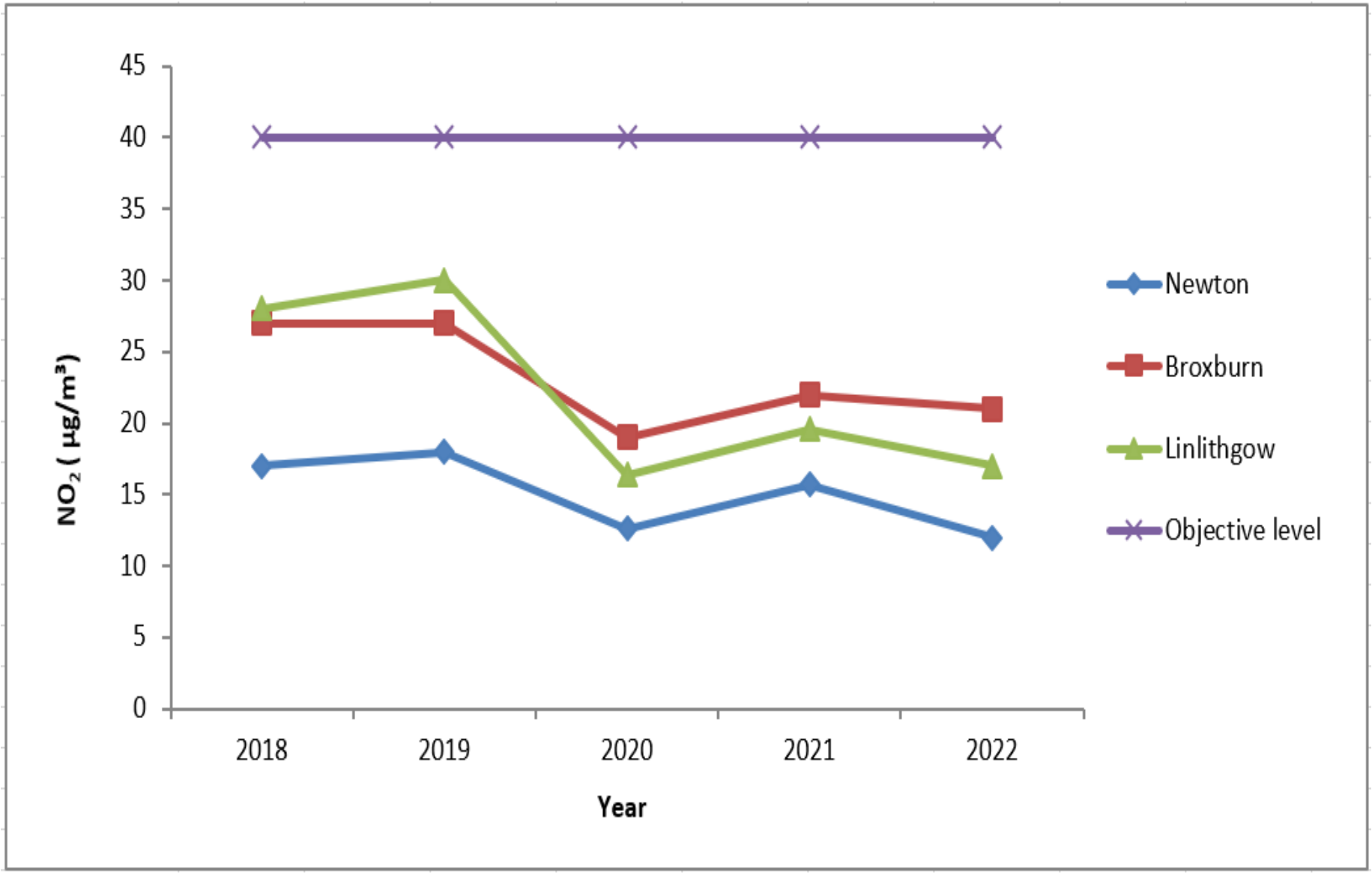


Figure 8 – Air Quality Management Area Maps – Linlithgow Air Quality Management Area

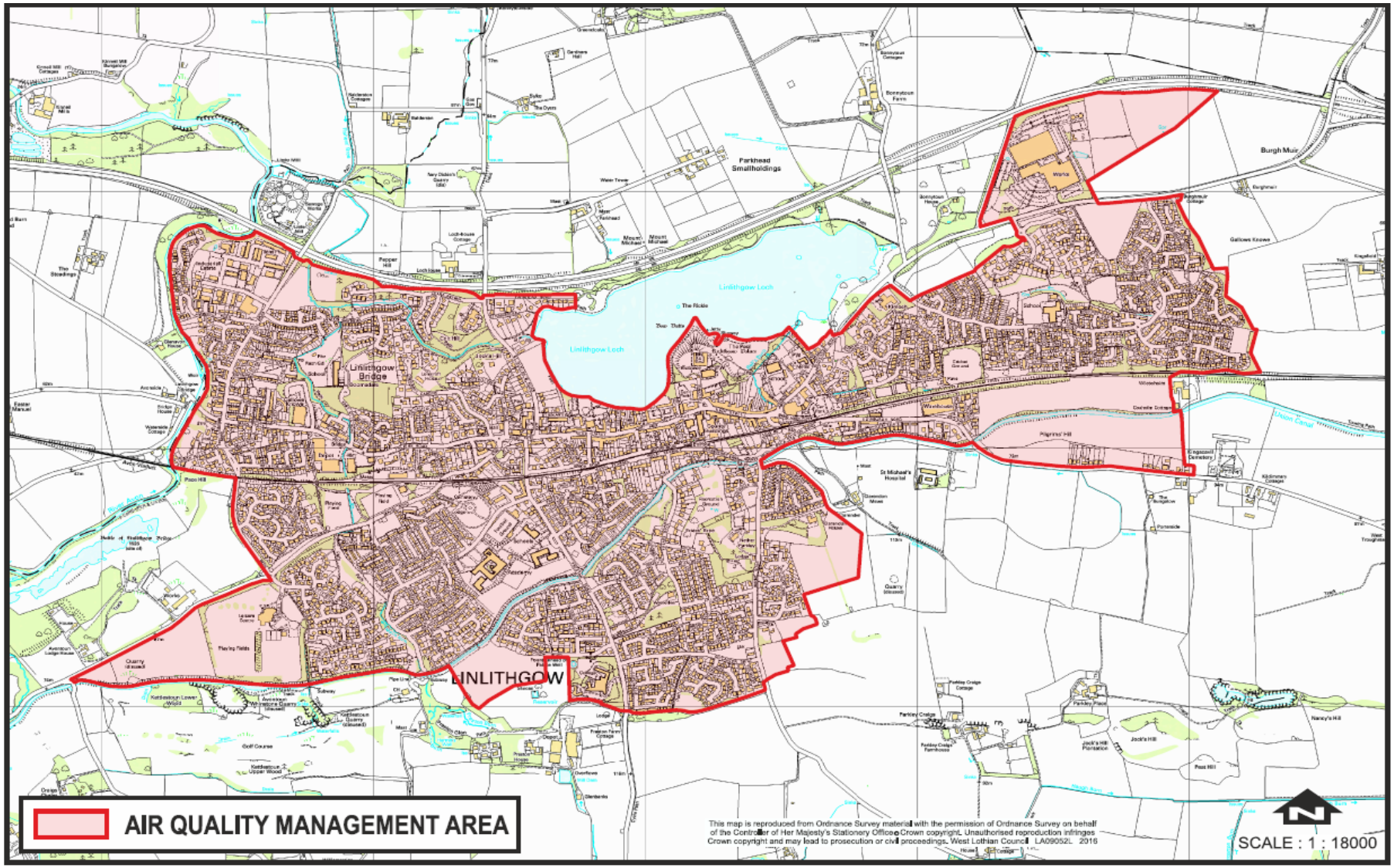


Figure 9 – Broxburn Air Quality Management Area

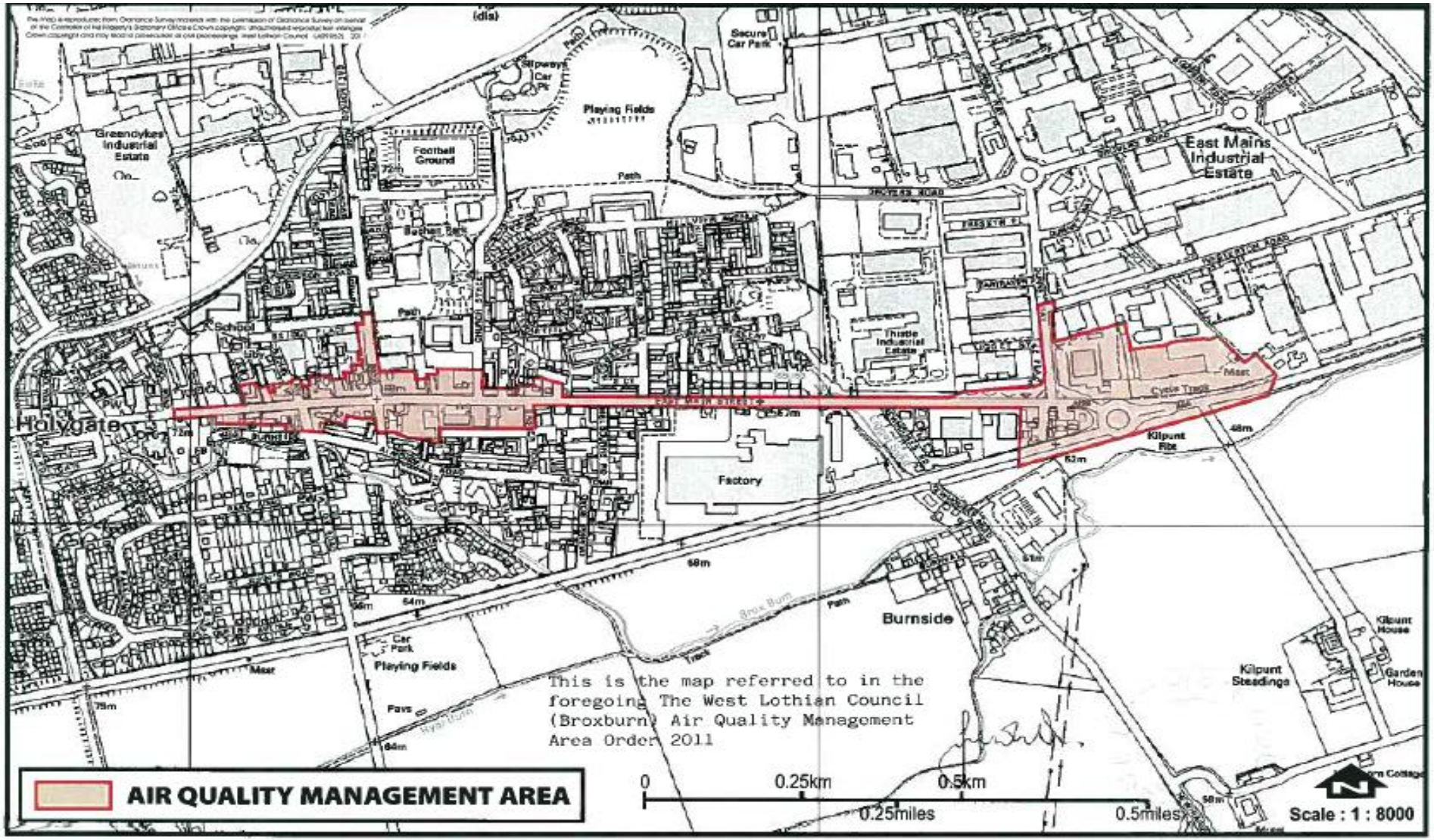


Figure 10 – Newton Air Quality Management Area

Figure 11 – Diffusion Tube Locations Map

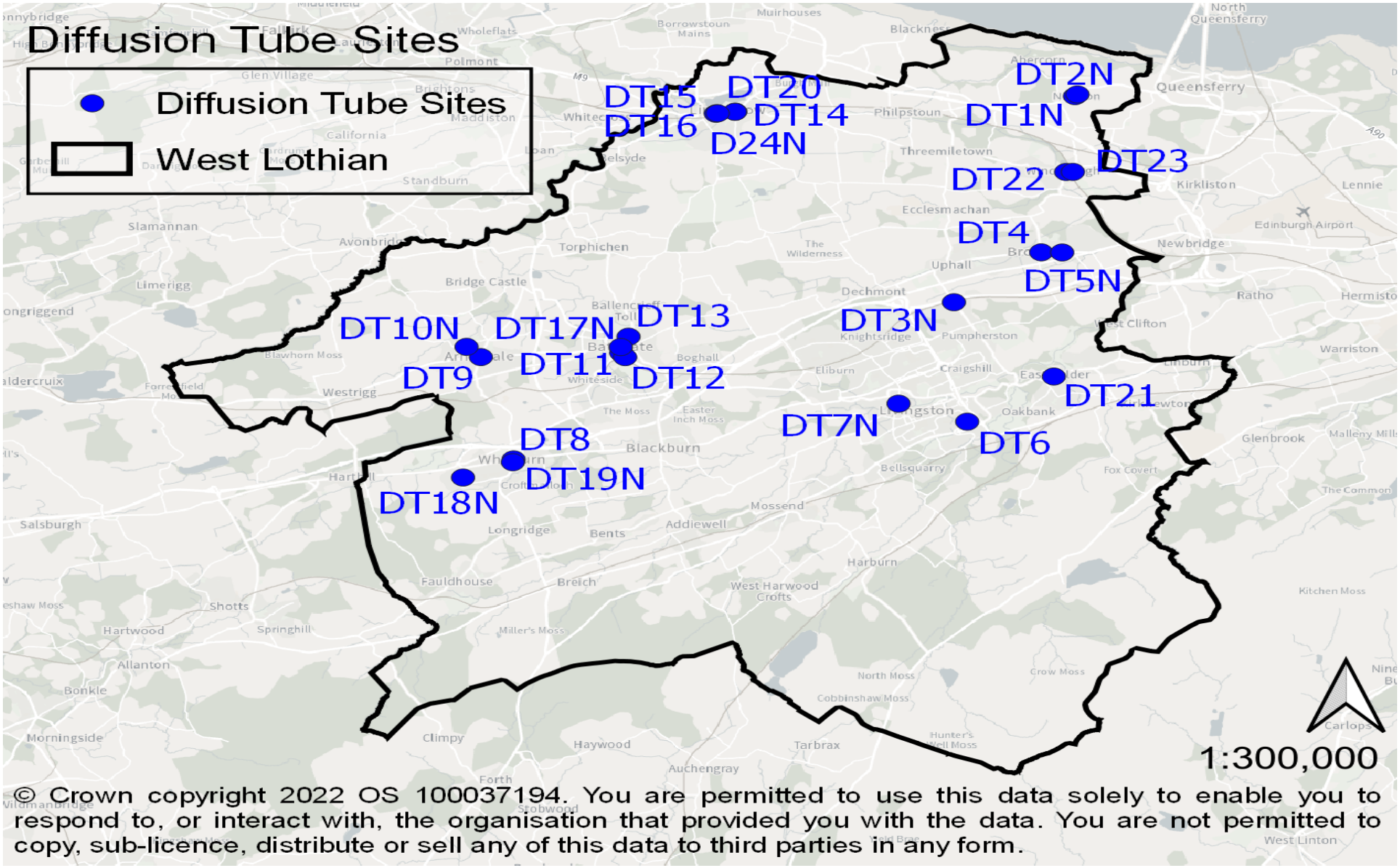
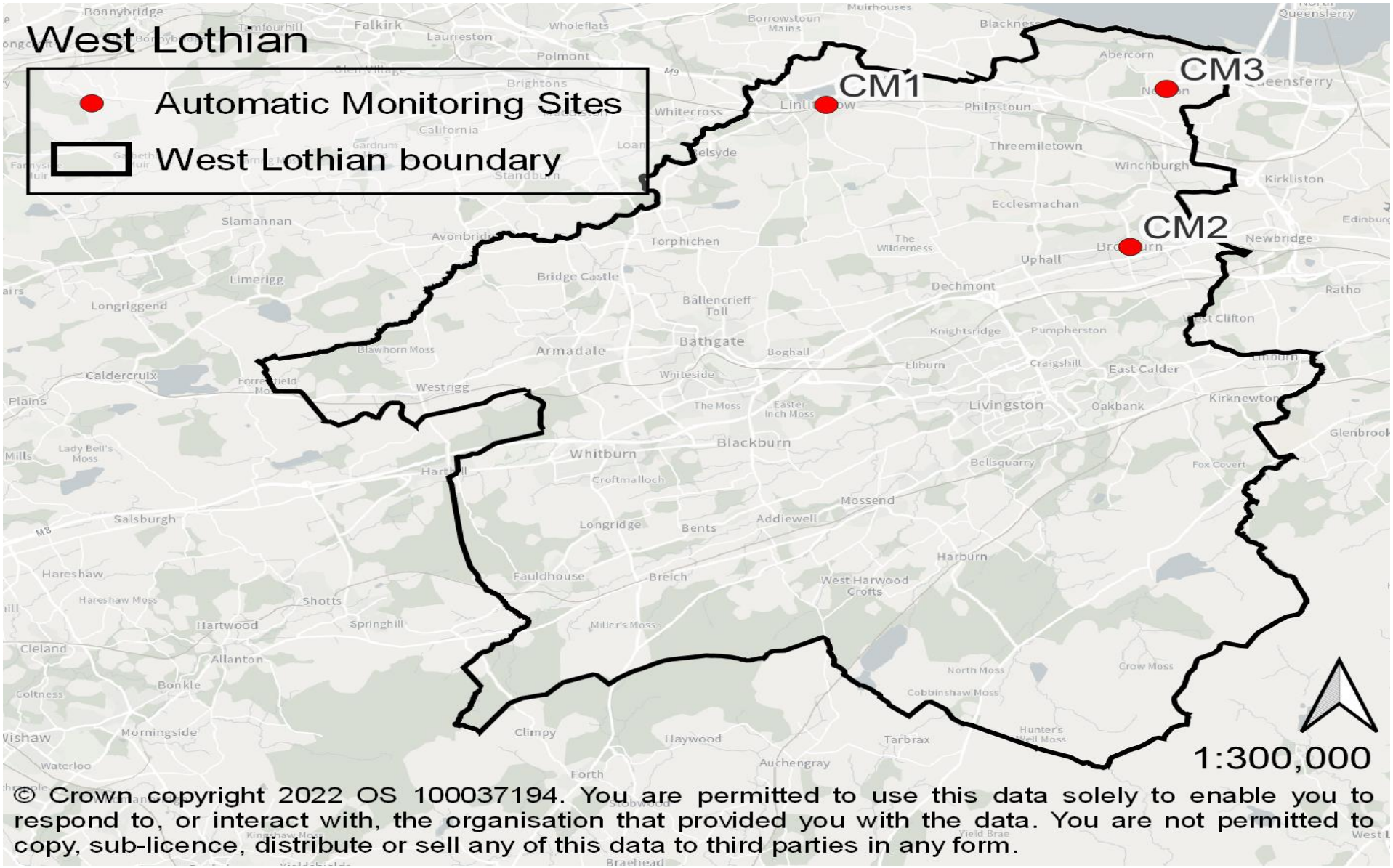


Figure 12 – Map of Continuous Monitoring Locations in West Lothian



Glossary of Terms

Abbreviation	Description
AQAP	Air Quality Action Plan - A detailed description of measures, outcomes, achievement dates and implementation methods, showing how the LA 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
APR	Air quality Annual Progress Report
AURN	Automatic Urban and Rural Network (UK air quality monitoring network)
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
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

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