Sunderland City Council

2023 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995 Local Air Quality Management, as amended by the Environment Act 2021

Date: June 2023

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Executive Summary: Air Quality in Our Area

We are pleased to be able to report that the Air Quality in Sunderland is good. Health based objectives known as the Air Quality Objectives are being met across the City and we have seen a general decline in the pollutants measured. We have not declared any Air Quality Management Areas in our City.

Sunderland City Council is committed to try to reduce levels further and to support initiatives that will improve air quality and well-being in Sunderland. We are continuing to monitor levels of air quality throughout the city; Appendix A of this report contains a summary of air quality data collected in 2022. Our real time monitoring data as well as data from other sites across the region can be accessed by going to www.wecare4air.co.uk.

We also look at new sources such as new roads or industrial sites to assess their potential impact on the City's air quality.

Together with our partners in Transport and Public Health we aim to work together to try to improve air quality and there are ways that Sunderland's residents and businesses can get involved too.

Sunderland residents and businesses can get more information by visiting http://gosmartergoactive.co.uk/.

Air Quality in Sunderland

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, the elderly, and those with existing heart and lung conditions. There is also often a strong correlation with equalities issues because areas with poor air quality are also often less affluent areas[1,2].

The mortality burden of air pollution within the UK is equivalent to 29,000 to 43,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

Pollutants come from a variety of man-made sources such as industry, combustion of fuels, traffic engines and building heating. Some can come from natural sources such as the North Sea which adds to particulate levels. Air Quality in Sunderland is most heavily influenced by traffic emissions. The pollutant of most concern to Sunderland is Nitrogen Dioxide (NO_2) caused by road traffic.

Levels of pollution across Sunderland, indicated by the latest monitoring data, are falling and Sunderland has not had to declare an AQMA within its boundary

Sunderland City Council's Environmental Health Team is responsible for overseeing the air quality monitoring network and reporting the data to DEFRA. We work together with other Local Authorities in our region as Air Pollution crosses administrative boundaries. Improvements to the road network or fitting buses with pollution reducing technology will have positive benefits in more than one local authority region in our area. The GoSmarter project mentioned earlier operates across all the Tyne & Wear Authorities and Northumberland.

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[1] Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017

[2] Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006

[3] Defra. Air quality appraisal: damage cost guidance, January 2023

[4] Public Health England. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report, May 2018

We also work closely with our partners in Transport, Public Health and Planning as well as partners outside the Local Authority such as the Environment Agency to improve air quality standards.

Actions to Improve Air Quality

Whilst air quality has improved significantly in recent decades, there are some areas where local action is needed to protect people and the environment from the effects of air pollution.

The Environmental Improvement Plan[5] sets out actions that will drive continued improvements to air quality and to meet the new national interim and long-term $PM_{2.5}$ targets. The National Air Quality Strategy, due to be published in 2023, will provide more information on local authorities' responsibilities to work towards these new targets and reduce $PM_{2.5}$ in their areas. The Road to Zero[6] details the approach to reduce exhaust emissions from road transport through a number of mechanisms; this is extremely important given that the majority of Air Quality Management Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

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.

Sunderland City Council currently does not have any AQMAs. For reference, a map of Sunderland's monitoring locations is available in Appendix D.

[5] Defra. Environmental Improvement Plan 2023, January 2023

[6] DfT. The Road to Zero: Next steps towards cleaner road transport and delivering our Industrial Strategy, July 2018

Conclusions and Priorities

We are pleased to report that no exceedances of the Air Quality Objectives were identified during the year 2022. Sunderland City Council does not currently have any AQMA's and because of our good air quality we conclude that we do not need to declare an AQMA for any pollutants.

Looking back over the last 5 years of data there has been a general decrease in NO_2 levels. During 2018 we saw mixed results at our monitoring sites. Both automatic sites reported a small increase in annual mean NO_2, whilst at diffusion tube sites there were 22 sites reporting lower concentrations and the remaining 12 comparable sites showing an increase. The figures for 2019 demonstrate mixed results once more. One of our automatic sites reported an increase whilst the other a decrease though none of the increased values exceeded the air quality objective. Across the diffusion tube network, 23 sites reported an increase (although in many cases this was very small) and 15 sites have decreased concentrations. The NO_2 results gathered during 2020 have demonstrated a fall in concentrations at every monitoring site, both automatic and sites monitored by diffusion tube. This was not wholly unexpected and is likely to be attributed to reduced traffic on the region's roads caused by restrictions brought about by the COVID-19 Pandemic. There has also been a shift towards working from home and this may continue to reduce traffic levels and therefore pollution in the future. During 2021, as the restrictions were lifted there has been a corresponding small increase in NO_2 levels at our site in Trimdon Street and at the AURN site on Wessington Way. At our diffusion tube sites, all but one site showed an increase in concentrations in 2021 compared to 2020. During 2022 levels of NO_2 have fallen again. All 3 continuous monitoring sites showed a decrease in concentrations and similarly all diffusion tube sites apart from one had a decreased annual mean.

Concentrations of NO_2 are lower overall than they were 5 years ago.

The annual average of Particulate Matter (PM_{10}) has remained fairly constant over the past 5 years. Levels at the Trimdon Street site have fluctuated whilst at our urban background site in Silksworth, the level of both PM_{10} and $PM_{2.5}$ has remained the same as in 2020. There was a slight increase at both sites in 2022 when compared to 2021.

Local Engagement and How to get Involved

Sunderland residents and businesses can get more information by visiting http://gosmartergoactive.co.uk/. Up to date Air Quality data can be accessed by visiting Sunderland Trimdon Street - We Care 4 Air.

In April 2022, a trial scheme will see a street temporarily closed around St Bede's Primary School, Washington, to address road safety concerns and improve air quality. The School Streets pilot scheme will restrict motorised vehicles on Hampshire Place at school drop-off and pick-up times to reduce high traffic levels and inconsiderate or illegal parking around the school.

The scheme also aims to encourage active travel to and from school and improve air quality in the area. The pilot will be reviewed after 18 months to consider if the scheme should be made permanent.

Sunderland City Council has received further funding from Active Travel England to allow construction of a new dedicated two-way cycle track along the A183 Whitburn Road.

The proposals are in line with the city council's commitment to create a dynamic, healthy, and vibrant city, promoting the use of alternative, sustainable modes of transport and

healthy living. Work on the scheme is well underway and should be completed in Spring 2024.

Encouraging cycling instead of driving is another step towards cutting Sunderland's carbon emissions as well as air pollution from traffic, as the council and partners are committed to making the city carbon neutral by 2040.

Sunderland City Council have recently been awarded Smart City of the Year and as part of the Smart City Project, upgrades have been made to vital digital infrastructure connecting the city through the continuing rollout of free ultrafast public 5G Wi-Fi and a City-wide LoRaWAN (long range, low powered network).

This improved connectivity has paved the way for the installation of low-cost sensors across the city. There are 30 air quality sensors in total, which can monitor a range of air pollutants including $PM_{2.5}$ and are anticipated to be a useful source of air quality information for our area. There are also more than 70 traffic sensors which provide a transport solution for traffic mapping to inform future traffic flow and allow real-time traffic management. More information on the project can be found at Welcome to Our Smart City of Sunderland (sunderlandoursmartcity.com)

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1 Local Air Quality Management

This report provides an overview of air quality in Sunderland 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 order to achieve and maintain the objectives and the dates by which each measure will be carried out. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Sunderland City Council to improve air quality and any progress that has been made.

The statutory air quality objectives applicable to LAQM in England are presented in Table E.1.

2 Actions to Improve Air Quality

Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority should prepare an Air Quality Action Plan (AQAP) within 18 months. The AQAP should specify how air quality targets will be achieved and maintained and provide dates by which measures will be carried out.

Sunderland City Council currently does not have any declared AQMAs.

For reference, monitoring locations in Sunderland are shown in Appendix D.

Progress and Impact of Measures to address Air Quality in Sunderland.

Defra's appraisal of last year's ASR concluded that, "on the basis of the evidence provided by the local authority the conclusions reached are **accepted** for all sources and pollutants".

Commentary was also provided with suggestions to improve this year's report such as including an air quality objective line on the graph for $PM_{2.5}$ and ensuring all figures are correctly labelled so that the information is clear to the reader. These comments have been taken on board and implemented for this year's report.

Sunderland has taken forward a number of direct measures during the current reporting year of 2022 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.1. 23 measures are included within Table 2.1, with the type of measure and the progress Sunderland have made during the reporting year of 2022 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2.1.

Although Sunderland City Council does not currently have an AQMA and therefore has not produced an AQAP, the measures listed in table 2.2 demonstrate some of the key projects that are currently ongoing and that should have a positive impact on Air Quality and reduce pollutant concentrations.

It is the intention of Sunderland City Council to produce and implement an Air Quality Strategy in the near future. A joint approach with relevant departments within the council will be adopted. It is hoped that by working together will ensure we can continue to meet the AQ Objectives and also look at long term strategies to reduce pollutants such as $PM_{2.5}$.

Table 2.1 – Progress on Measures to Improve Air Quality

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
1	Go Ultra Low Cities (Fastned)	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2018	2019	North-East Combined Authority (NECA)	Go Ultra Low Cities Grant and the European Regional Development Fund.	NO	Funded	£1 million - £10 million	Completed	Reduced vehicle emissions	Measured concentrations at AQ Sites	Completed	
2	EV Charging Infrastructure review	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2022	2022	Gateshead, North Tyneside, Newcastle and Nexus	NECA Sustainable Transport Group	NO	Funded		Implementation	Reduced vehicle emmisisons	Measured concentrations at AQ Sites	Regional procurement in progress with a view to contract award in autumn 2023	
3	Ultra-low emission taxi infrastructure scheme Round 2	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2018	2020	North East Combined Authority (NECA)	North East Combined Authority (NECA)	NO	Funded	£500k - £1 million	Implementation	Reduced vehicle emissions	Measured concentrations at AQ Sites	EV points for electric taxis to be provided across the North East. To be installed in Houghton-Le-Spring.	Engagement with taxi industry ongoing to support EV uptake (2023)
4	Connect 700 Bus Service	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	2012	2019	University of Sunderland & Nexus	University of Sunderland & Nexus	NO	Funded		Implementation	Reduced vehicle emissions	Measured concentrations at AQ Sites	The bus service continues to run. Operated with Euro standard compliant vehicles.	
5	Ultra low emissions bus fund	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	2022	2023	North East Combined Authority (NECA) & Nexus	Levelling Up Fund	NO	Funded			Reduced vehicle emissions	Measured concentrations at AQ Sites	Funding secured to deliver 20 electric buses.	
6	Walking & Cycling Strategy	Promoting Travel Alternatives	Promotion of cycling, Promotion of walking	2012	2025	Local Authority	Local Authority	NO	Funded	£50k - £100k	Planning	Reduced vehicle emissions	Measured concentrations at AQ Sites	Local cycling and Walking Infrastructure Plan is now adopted. Schemes are being developed and delivered.	
7	Electric Bikes for staff business travel	Promoting Travel Alternatives	Promotion of cycling	2020	2023	Local Authority	Local Authority	NO	Funded	£50k - £100k	Implementation	Reduced vehicle emissions	Measured concentrations at AQ Sites	E bikes are now available for use by council staff.	
8	Cycle to work salary cycle scheme	Promoting Travel Alternatives	Promotion of cycling	2017	2017	Local Authority	Local Authority	NO	Funded		Completed	Reduced vehicle emissions	Measured concentrations at AQ Sites	on going	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
9	E-scooters Trail - 300 provided with plans to extend	Promoting Travel Alternatives	Promoting Low Emission Public Transport	2021	2022	Neuron	Local Authority/ Neuron	NO	Funded		Completed	Reduced vehicle emissions	Measured concentrations at AQ Sites	Operating zone tripled in size in April 2022.	Trial extended but unlikely to continue (2023)
10	School Street Closure	Promoting Travel Alternatives	Promotion of walking	2021	2022	Primary Schools & Northumbria Police	Local Authority	NO	Funded		Implementation	Reduced vehicle emissions	Measured concentrations at AQ Sites	First primary school trial underway for 18-month period	Pilot to be reviewed for moving parent/carer parking and road safety benefits
11	Rapid Cluster Site EV Charging	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2020	2030	North East Combined Authority (NECA)	North East Combined Authority (NECA)	NO	Funded		Completed	Reduced vehicle emissions	Measured concentrations at AQ Sites	Delivered. Funding secured for further 3 sites.	
12	OLEV Workplace EV Chargers	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2020	2030	Local Authority	Local Authority	NO	Funded		Implementation	Reduced vehicle emissions	Measured concentrations at AQ Sites	Funding secured to install EV chargers at several Sunderland Council Sites	Workplace charging delivered at satellite offices/depots
13	On Street EV Charging Scheme	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2022	2030	Local Authority	Local Authority	NO	Funded		Planning	Reduced vehicle emissions	Measured concentrations at AQ Sites	Pilot on-street residential scheme delivered. Grant funding secured for next phase.	
14	ERDF Programme	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2020	2023	South Tyneside, Gateshead and Sunderland Local Authorities	ERDF	NO	Funded		Implementation	Reduced vehicle emissions	Measured concentrations at AQ Sites	Charge points delivered.	
15	Energy Generation & Storage Project	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2022	2025	Local Authority	Local Authority	NO	Funded		Planning	Reduced vehicle emissions	Measured concentrations at AQ Sites	Contractor appointed, installation progressing. Solar PV delivered to various council buildings.	

Measure No.	Measure	Category	Classification	Year Measure Introduced in AQAP	Estimated / Actual Completion Date	Organisations Involved	Funding Source	Defra AQ Grant Funding	Funding Status	Estimated Cost of Measure	Measure Status	Reduction in Pollutant / Emission from Measure	Key Performance Indicator	Progress to Date	Comments / Barriers to Implementation
16	Fleet Replacement Programme	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2020	2021	Local Authority	Local Authority	NO	Funded		Completed	Reduced vehicle emissions	Measured concentrations at AQ Sites	Initial study on electrifying Sunderland Fleet vehicles. Further electric vans on order.	
17	3 Electric Refuse Vehicles trial	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2020	2020	Local Authority	ERDF	NO	Funded		Completed	Reduced vehicle emissions	Measured concentrations at AQ Sites	funding secured for one eRCV. Local match and vehicle procured and operational.	
18	City Centre Heat Network	Promoting Low Emission Plant	Low Emission Fuels for stationary and mobile sources in Public Procurement	2021	2023	HNDU, BEIS and LA.	HNDU	NO	Not Funded		Planning	Reduced Plant emissions	Measured concentrations at AQ Sites	Initial Study complete. Funding applications and project delivery stage. Planning permission secured.	
19	Mine Source Energy	Promoting Low Emission Plant	Low Emission Fuels for stationary and mobile sources in Public Procurement	2020	2023	Coal Authority, HNDU	Local Authority	NO	Not Funded		Planning	Reduced Plant emissions	Measured concentrations at AQ Sites	Initial study complete. Next stage under consideration. Procurement in progress.	
20	Zero Emission Vehicle Policy	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	2022	2024	North East Combined Authority (NECA)	North East Combined Authority (NECA)	NO	Funded		Planning	Reduced vehicle emissions	Measured concentrations at AQ Sites	3-year EV Infrastructure Delivery Plan and Roadmap developed	
21	EV Infrastructure Strategy for Sunderland	Policy Guidance and Development Control	Low Emissions Strategy	2022	2024	University of Sunderland, Sunderland College, City Hospitals, Gentoo	Local Authority	NO	Funded		Planning	Reduced vehicle emissions	Measured concentrations at AQ Sites	Project partner appointed, stakeholder engagement stage. As above.	
22	Mobility Hub with EV car club located in Riverside Sunderland	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2020	2022	Local Authority, Riverside residents	Local Authority	NO	Funded		Implementation	Reduced vehicle emissions	Measured concentrations at AQ Sites	Workplace hub for staff travel by EV, e-bike, cycle, e-scooter and public transport incentives	Operational and staff EV taster sessions held to promote use
23	Nissan36Zero creation of a microgrid including energy generation and EV battery production.	Promoting Low Emission Plant	Low Emission Fuels for stationary and mobile sources in Public Procurement	2020	2023	Nissan, Envision	Nissan, Envision	NO	Funded	> £10 million	Implementation	Reduced Plant emissions	Measured concentrations at AQ Sites	Construction commenced; construction continues.	

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

As detailed in Policy Guidance LAQM.PG22 (Chapter 8), 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.

Background on the impacts on health outcomes and rationale:

The people of Sunderland have lower life expectancy at birth than the England average, with a gap of 2.2 years for males and 2.4 years for females. Data published recently shows that:

- 17.1% of the gap for males and 24.1% of the gap for females is due to deaths from respiratory diseases.
- 13.4% of the gap for males and 16.2% of the gap for females is due to deaths from circulatory diseases.

28.1% of the gap for males and 34.3% of the gap for females is due to deaths from cancer. Evidence shows that long term exposure to poor air quality increases the risk of mortality from cardiovascular and respiratory diseases and also lung cancer. Sunderland has higher than England average rates of death for these causes as follows:

- Premature (under 75 years) mortality rates from cardiovascular disease of 93 per 100,000 compared to 76 per 100,000 for England; of this 62 per 100,000 were preventable.
- Premature (under 75 years) mortality rates from respiratory disease of 44 per 100,000 compared to 33 per 100,000 for England; of this 28 per 100,000 were preventable.

- Premature (under 75 years) mortality rates from lung cancer of 50 per 100,000 compared to 34 per 100,000 for England; around 89% of lung cancers are preventable.

Data from the Public Health Outcomes Framework suggests that man-made small particulate air pollution ($PM_{2.5}$) contributes to deaths in the City and the burden this create on our population is equivalent to 4.5% of all deaths at ages 30 years and over. This places Sunderland is the best performing quartile for this measure.

Levels of $PM_{2.5}$ in Sunderland (as measured by the Silksworth CM2 monitoring station) are generally relatively low and have increased only slightly compared to 2021. Data for 2022, at 8µg/m^3 are well below the EU target of 25µg/m^3.

Actions already being taken by Sunderland City Council to reduce pollutants such as PM_{10} and NO_x as reported in Table 2.2 will also reduce levels of $PM_{2.5}$ emissions.

Sunderland City Council is taking the following measures to address $PM_{2.5}$. Examples of measures to tackle $PM_{2.5}$ can be categorised into Mobile Sources, Stationary Sources and Area Sources.

Mobile Sources

Sunderland Council has recently secured funding for the retrofitting of diesel buses which will help to reduce primary and secondary sources of $PM_{2.5}$.

Stationary Sources

Stationary sources of $PM_{2.5}$ can originate from industrial processes that use dusty raw materials and equipment such as electrostatic precipitators. The Environmental Health Team of Sunderland Council closely monitors dusty emissions from permitted processes and respond to any complaints regarding dust emissions from demolition and/or construction sites. We also control dust through the planning process by assessing proposed industrial and potentially dusty activities and advising on appropriate control measured, for example, ensuring construction sites have an adequate Construction Environmental Management Plan in place.

Area Source Measures

The whole of Sunderland City Council's boundary is a smoke control area and domestic coal is not permitted to be used as fuel. The
Environmental Health Team thoroughly investigates complaints of dark smoke or the use of unapproved appliances to minimise the emissions of $PM_{2.5}$ from these sources and promotes the Department for Environment Food & Rural Affairs practical guide for the use of open fires and wood burning stoves in the City

Sunderland City Council's Public Health Team are happy to support Environmental Health in promoting the importance of air quality in contributing to key priorities for the city and recommend that any actions that can reduce levels of $PM_{2.5}$ should be considered as part of the broad strategy to protect and promote the health of the Sunderland population.

To improve our understanding of $PM_{2.5}$ levels we have recently procured an upgrade of the analysers at our Trimdon Stret Site (CM1) within the city centre. This will include a particulate analyser that can measure both PM_{10} and $PM_{2.5}$ whereas previously only PM_{10} was measured. In addition, the smart sensor network that is currently being installed at locations across the city will also measure $PM_{2.5}$ and provide a valuable source of data to identify any hotspots and trends.

Further discussions between our partners in Public Health and Transport are required to improve our understanding. Sunderland City Council will continue to work towards reducing emissions and concentrations of $PM_{2.5}$ in their area as practicable.

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

This section sets out the monitoring undertaken within 2022 by Sunderland and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2018 and 2022 to allow monitoring trends to be identified and discussed.

Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Sunderland undertook automatic (continuous) monitoring at 3 sites during 2022. Table A.1 in Appendix A shows the details of the automatic monitoring 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. The www.wecare4air.co.uk page presents automatic monitoring results for Sunderland, with automatic monitoring results also available through the UK-Air website .

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

Sunderland undertook non- automatic (i.e. passive) monitoring of NO_2 at 35 sites during 2022. Table A.2 in Appendix A presents the details of the non-automatic 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.

Individual Pollutants

The air quality monitoring results presented in this section are, where relevant, adjusted for bias, annualisation (where the annual mean data capture is below 75% and greater than 25%), and distance correction. Further details on adjustments are provided in Appendix C.

3.1.3 Nitrogen Dioxide (NO_2)

Table A.3 and Table A.4 in Appendix A compare the ratified and adjusted monitored NO_2 annual mean concentrations for the past five years with the air quality objective of 40µg/m^3. Note that the concentration data presented represents the concentration at the location of the monitoring site, following the application of bias adjustment and annualisation, as required (i.e. the values are exclusive of any consideration to fall-off with distance adjustment).

For diffusion tubes, the full 2022 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

Table A.5 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 of the annual or 1-hour air quality objectives for NO_2 at all of the monitoring locations.

The annual mean at CM1, CM2 and CM3 slightly decreased when compared to the data collected in 2021. It is possible that the increased ability for home working has led to a reduction in traffic on the roads in Sunderland and therfore a reduction in NO2. This trend is also echoed in the National Statistics[1]for NO_2 (Nitrogen dioxide (NO2) - GOV.UK (www.gov.uk)) which showed a small decrease of roadside concentrations between 2021 and 2022. A.1 shows a comparison of the last 5 years data.

The diffusion tube results demonstrated a similar trend to the continuous analysers with all but one site having a decreased concentration. Figures A.2 and A.3 show the diffusion tube data for 2018 to 2022.

3.1.4 Particulate Matter (PM_{10})

Table A.6 in Appendix A: Monitoring Results compares the ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years with the air quality objective of 40µg/m^3.

Table A.7 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 35 times per year.

However, it must be noted that the data from CM1 was collected using a TEOM. In previous years the data has been corrected using the VCM model but the removal of a nearby FDMS analyser has meant that there is no longer an analyser in range and the correction model cannot be used. After seeking advice from the LAQM helpdesk, the data was corrected using a factor of 1.3 but it cannot be relied heavily upon to make conclusions. When compared with the last 5 years data the annual concentration is slightly higher than it has been previously but is not dramatically different, see Fig A.

Relying on the data from CM2, there were no exceedances of the annual or daily air quality objective for PM_{10} in Sunderland for the year 2022. Annual concentrations of PM_{10} increased at both CM1 and CM2 when compared to the previous year's levels. The number of 24-hour means >50µg/m^3 increased at CM1 by one and remained the same at 0 days for CM2.

3.1.5 Particulate Matter ($PM_{2.5}$)

Table A.8 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations for the past five years.

Concentrations of $PM_{2.5}$ were measured at CM2. This is an affiliate AURN site and as such the data has been correctly ratified and is available from the Data Archive - Defra, UK . There were no exceedances of the $PM_{2.5}$ objective at the monitoring location. Levels in 2022 increased slightly from 6 µg/m^3 to 8 µg/m^3 in 2021.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
CM1	Trimdon Street	Kerbside	438928	557151	NO2, PM10	NO	Chemiluminescent; TEOM	3	0.5	2
CM2	Silksworth	Urban Background	438116	554462	NO2, PM10, PM2.5	NO	Chemiluminescent, FIDAS	230	0.5	2
CM3	Wessington Way	Roadside	438020	558348	NO2	NO	Chemiluminescent	15	1.5	1.8

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

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
38	17 Parkside South, East Herrington	Roadside	435714	552473	NO2	No	0.0	18.0	No	2.0
53	166 Chester Road, Millfield	Roadside	438568	556566	NO2	No	0.0	4.0	No	2.0
55	25 Eden Vale, Thornholme	Roadside	438690	556135	NO2	No	0.0	3.0	No	2.0
56	101 Southwick Road, Southwick	Roadside	439101	558292	NO2	No	0.0	2.0	No	2.0
57	5/6 Northbridge Street, Monkwearmouth	Kerbside	439664	557829	NO2	No	0.0	2.0	No	2.0
58	6 Beatrice Terrace, Shiney Row	Kerbside	432634	552616	NO2	No	0.0	3.0	No	2.0
86	2 Alice Street, Thornholme	Roadside	439466	556484	NO2	No	0.0	4.0	No	2.0
88	Hind's Street, Central	Kerbside	439160	556995	NO2	No	165.0	0.0	No	4.0
94	Chaplins PH, Mary St. City Centre	Kerbside	439374	556660	NO2	No	2.0	2.0	No	4.0
100	Air Quality Trailer, Trimdon Street	Roadside	438927	557151	NO2	No	2.0	5.0	No	4.0

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
101, 105, 106	Puma Centre, Silksworth Lane	Urban Background	438116	554462	NO2	No	130.0	3.0	No	2.0
109	23 Newcastle Road, Bowling Alley	Roadside	439648	558120	NO2	No	0.0	3.0	No	2.0
111	237 Queen Alexandra Rd, Barnes roundabout	Roadside	438453	555507	NO2	No	0.0	9.0	No	2.0
113	Durham Road Prospect Junction	Urban Centre	437446	554989	NO2	No	20.0	4.0	No	2.0
117	3, Holmeside (Baker's Oven)	Roadside	439495	556795	NO2	No	97.0	4.0	No	2.0
118	27 Bridge Street	Roadside	439696	557205	NO2	No	0.0	2.0	No	2.0
119	4 Athenaeum Street	Roadside	439792	556921	NO2	No	88.0	2.0	No	4.0
120	Gillespie's	Roadside	439806	557063	NO2	No	100.0	5.0	No	4.0
121	16 Windsor Terrace, Grangetown	Roadside	440702	554722	NO2	No	0.0	2.0	No	4.0
123	263 Chester Road	Roadside	437943	556341	NO2	No	10.0	4.0	No	4.0
125	45 Station Road	Roadside	435417	547025	NO2	No	0.0	2.0	No	4.0
128	Echo Building (lamp post)	Roadside	439707	557312	NO2	No	20.0	2.0	No	4.0

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
129	West Sunniside (lamp post)	Roadside	439938	557089	NO2	No	2.0	1.0	No	2.0
130	St Mary's Car Park Matlock Street lamp post	Roadside	439538	557292	NO2	No	177.0	3.0	No	2.0
132	Dunn House North Bridge Street	Roadside	439661	557901	NO2	No	0.5	3.0	No	4.0
133	Northern Way	Roadside	438123	558344	NO2	No	0.0	3.0	No	4.0
134	Southwick Rd/ Thompson Rd	Roadside	438563	558517	NO2	No	0.0	2.0	No	4.0
135	Merle Terrace	Roadside	437561	557538	NO2	No	0.0	4.0	No	4.0
136	1, Morningside	Roadside	428269	553809	NO2	No	0.0	9.0	No	4.0
137	9 Esthwaite	Roadside	429935	556631	NO2	No	0.0	26.0	No	4.0
138	Galleries Service Yard	Roadside	429984	556576	NO2	No	56.0	1.0	No	4.0
139	Rear of 79 Spout Lane	Roadside	430899	556961	NO2	No	8.0	0.0	No	4.0
140	3 Musgrove Terrace	Roadside	430877	556851	NO2	No	3.0	0.0	No	4.0
141	Jnctn Dairy Lane & Front St	Roadside	432542	549640	NO2	No	9.0	3.0	No	4.0

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Tube Co-located with a Continuous Analyser?	Tube Height (m)
142	3 Whitehall Terrace	Roadside	437224	556714	NO2	No	0.0	4.0	No	4.0

Notes:

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

(2) N/A if not applicable.

Table A.3 – Annual Mean NO_2 Monitoring Results: Automatic Monitoring (µg/m^3)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CM1	438928	557151	Kerbside		95.3	32	28	25	26.1	24.6
CM2	438116	554462	Urban Background		91	14	13	12	**no data**	11
CM3	438020	558348	Roadside		87	20	17	13	17	15

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

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

Notes:

The annual mean concentrations are presented as µg/m^3.

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

All means have been "annualised" as per LAQM.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

Table A.4 – Annual Mean NO_2 Monitoring Results: Non-Automatic Monitoring (µg/m^3)

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
38	435714	552473	Roadside	N/A	100.0	33.5	33.7	28.9	26.9	24.6
53	438568	556566	Roadside	N/A	100.0	25.3	25.6	15.1	21.1	18.8
55	438690	556135	Roadside	N/A	84.3	25.8	25.1	21.3	24.0	19.5
56	439101	558292	Roadside	N/A	100.0	22.2	26.0	18.5	22.2	18.1
57	439664	557829	Kerbside	N/A	55.8	27.1	32.2	22.2	31.6	22.6
58	432634	552616	Kerbside	N/A	100.0	32.2	33.0	19.8	25.4	19.8
86	439466	556484	Roadside	N/A	100.0	16.9	16.4	13.7	18.1	16.2
88	439160	556995	Kerbside	N/A	90.4	26.4	28.2	20.3	24.2	20.7
94	439374	556660	Kerbside	N/A	100.0	31.8	27.8	22.0	26.9	22.2
100	438927	557151	Roadside	100	57.4	33.5	35.2	25.3		20.4
101, 105, 106	438116	554462	Urban Background	N/A	100.0	29.9	30.1	20.8	13.8	10.8
109	439648	558120	Roadside	N/A	58.0	18.3	17.5	13.2	20.4	16.1

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
111	438453	555507	Roadside	N/A	92.3	18.8	26.9	22.0	15.6	11.9
113	437446	554989	Urban Centre	N/A	77.2	29.1	29.0	20.0	25.5	19.4
117	439495	556795	Roadside	N/A	100.0	28.3	28.6	24.5	22.8	23.0
118	439696	557205	Roadside	N/A	92.3	23.7	23.0	17.8	26.8	22.6
119	439792	556921	Roadside	N/A	100.0	23.0	23.6	17.4	19.6	17.5
120	439806	557063	Roadside	N/A	75.0	21.8	23.8	16.7	20.1	17.0
121	440702	554722	Roadside	N/A	78.6	30.5	32.5	21.2	16.7	14.0
123	437943	556341	Roadside	N/A	82.7	25.6	26.9	18.2	27.7	23.7
125	435417	547025	Roadside	N/A	100.0	22.3	26.1	22.8	20.3	16.6
128	439707	557312	Roadside	N/A	100.0	19.4	18.1	14.7	23.0	18.8
129	439938	557089	Roadside	N/A	100.0	25.0	22.1	17.6	14.9	13.4
130	439538	557292	Roadside	N/A	100.0	34.2	37.8	33.0	20.5	17.5
132	439661	557901	Roadside	N/A	84.6	28.2	25.1	18.7	34.7	29.3
133	438123	558344	Roadside	N/A	82.7	29.9	29.2	20.7	20.9	16.1

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2022 (%) [2]	2018	2019	2020	2021	2022
134	438563	558517	Roadside	N/A	100.0	19.6	21.4	15.6	23.9	21.0
135	437561	557538	Roadside	N/A	82.7	21.3	20.6	15.7	16.1	13.0
136	428269	553809	Roadside	N/A	100.0	18.2	20.3	14.6	15.7	12.1
137	429935	556631	Roadside	N/A	100.0	37.9	36.9	25.4	15.6	12.9
138	429984	556576	Roadside	N/A	82.7	23.9	23.7	15.4	29.9	24.9
139	430899	556961	Roadside	N/A	84.3	21.7	22.3	15.0	18.2	15.6
140	430877	556851	Roadside	N/A	82.7			18.5	16.6	12.9
141	432542	549640	Roadside	N/A	84.3			20.4	18.6	14.3
142	437224	556714	Roadside	N/A	100.0				24.7	21.8

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

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

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

Notes:

The annual mean concentrations are presented as µg/m^3.

Exceedances of the NO_2 annual mean objective of 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.TG22 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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

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

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

Figure A.1 – Trends in Annual Mean NO_2 Concentrations Automatic Sites

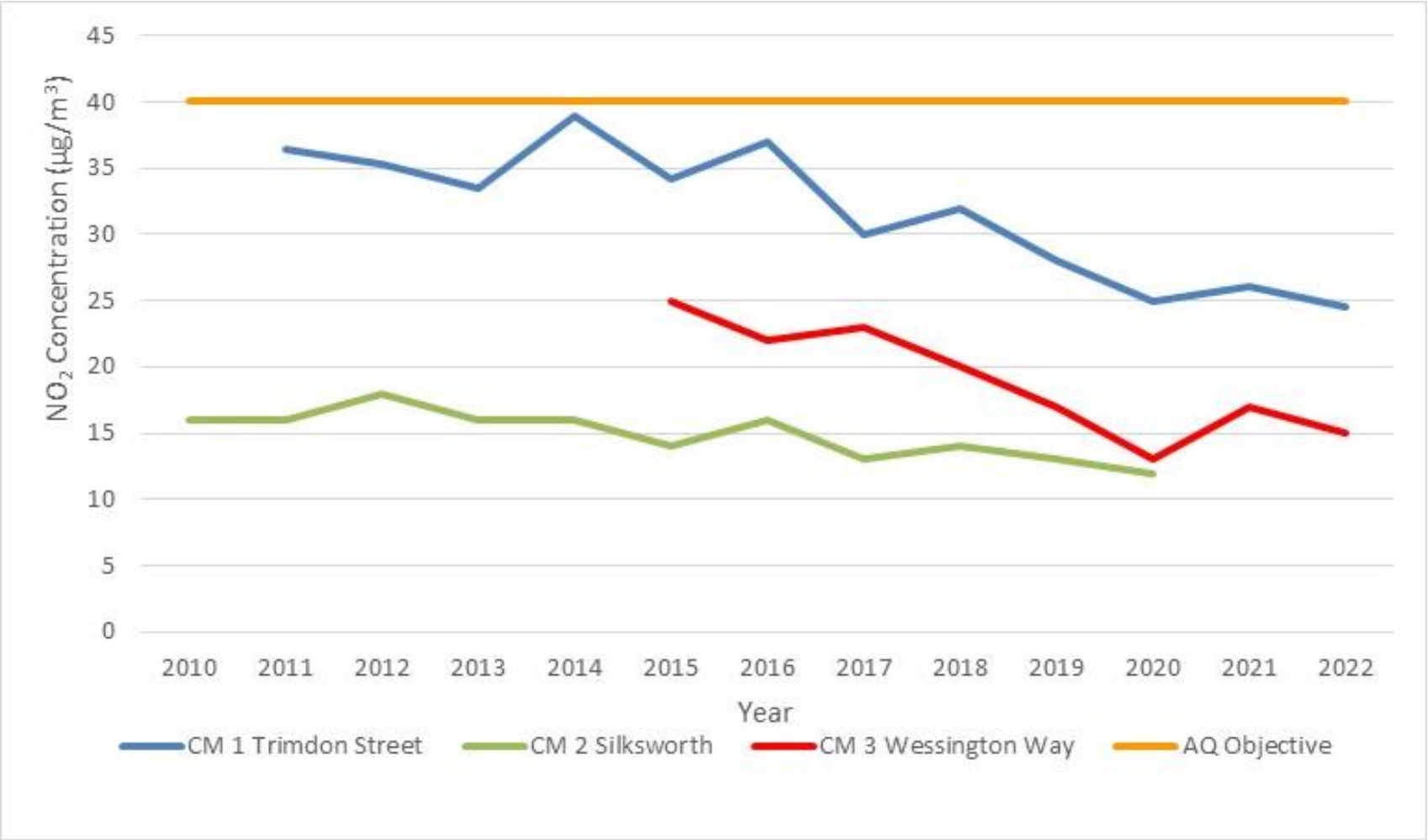

Figure A.2.1 – Trends in Annual Mean NO_2 Concentrations at Diffusion Tube Monitoring Sites 38 - 121

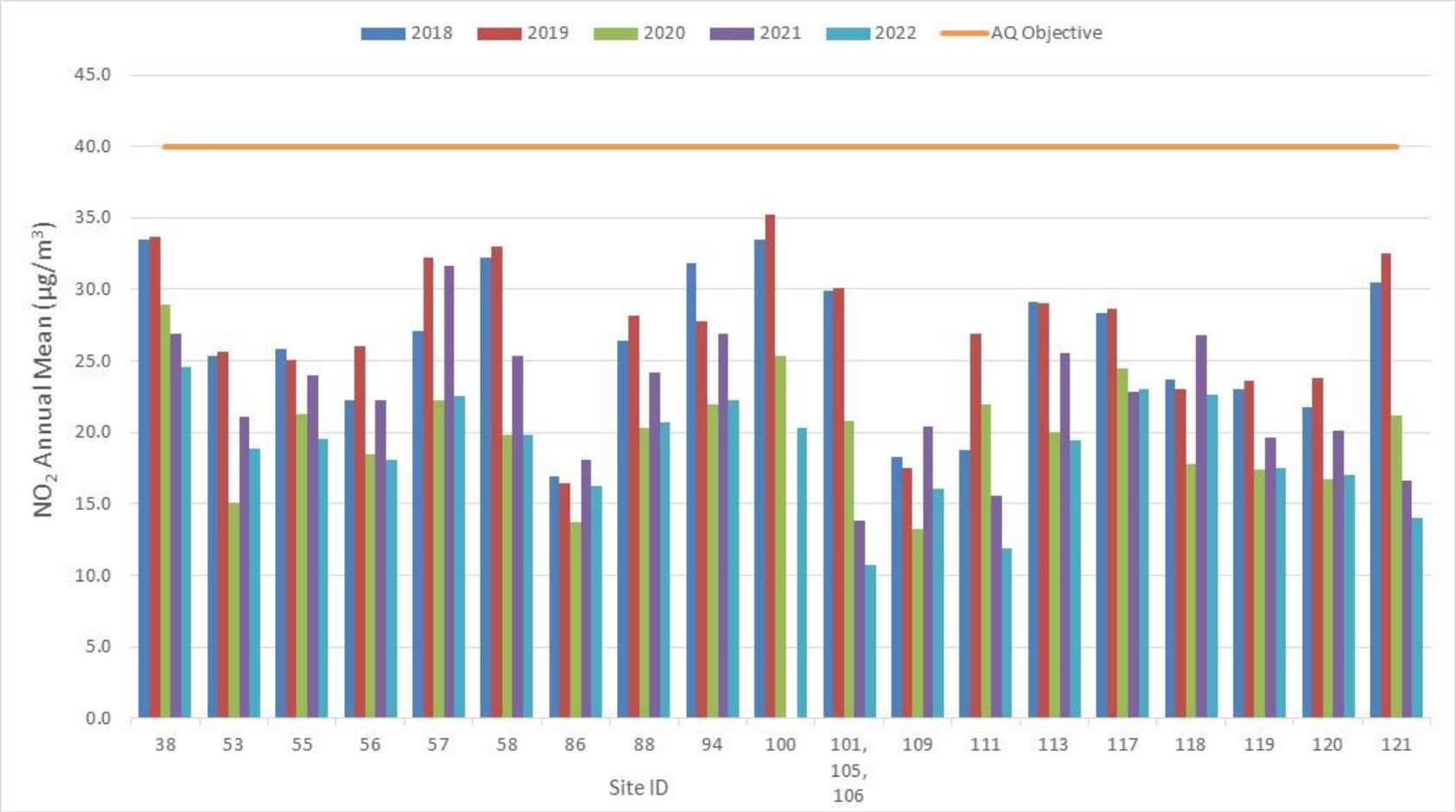

Figure A.3.2 – Trends in Annual NO_2 mean concentrations at Diffusion Tube Sites 125 - 142

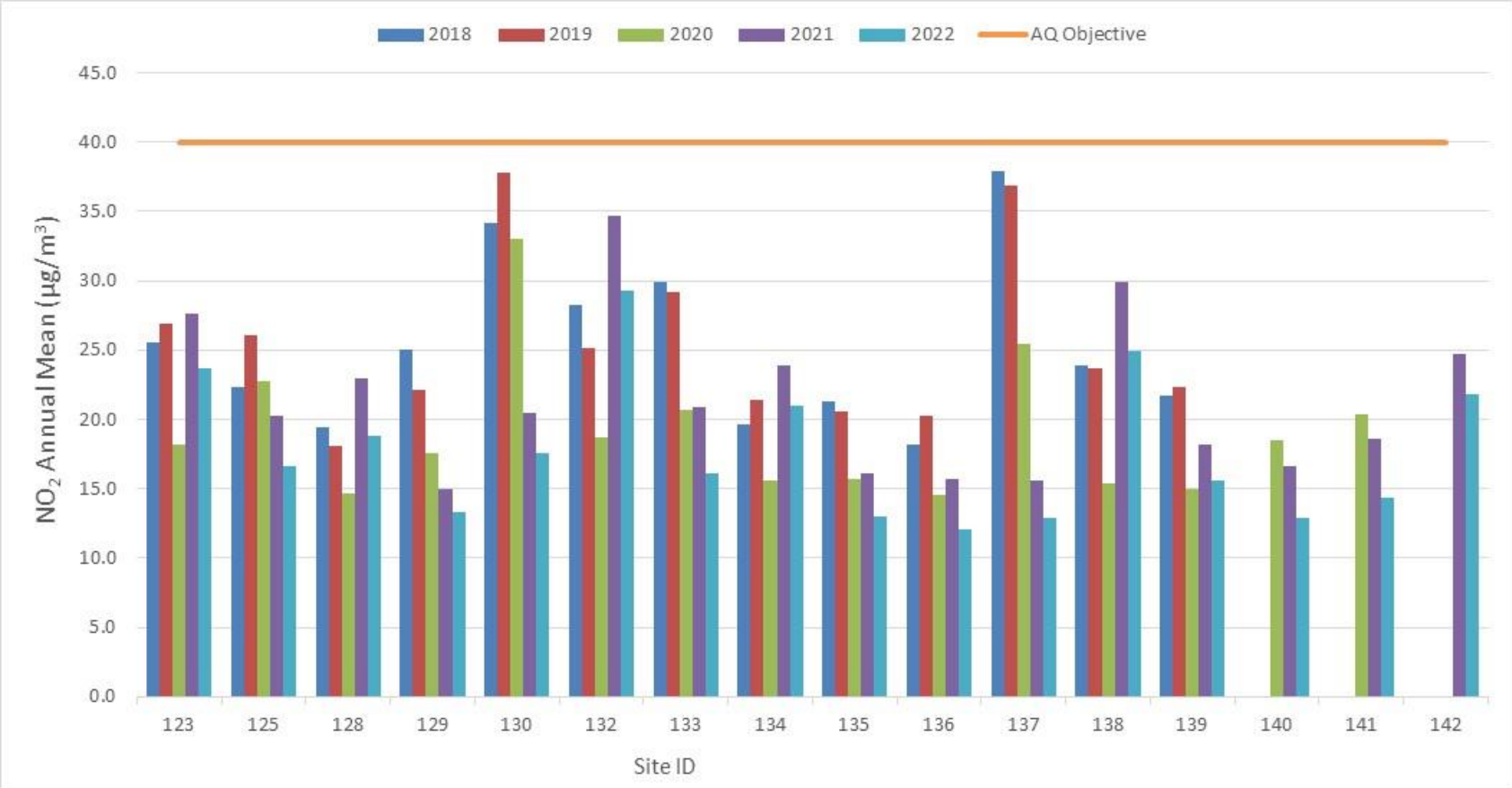

Table A.5 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CM1	438928	557151	Kerbside		95.3	0	0	0	0	0
CM2	438116	554462	Urban Background		91	0	0	0	0	0
CM3	438020	558348	Roadside		87	0	0	0	0	0

Notes:

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

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**.

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.6 – Annual Mean PM_{10} Monitoring Results ($\mu g/m^3$)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CM1	438928	557151	Kerbside		94	19	19	18	20.1	21.5
CM2	438116	554462	Urban Background		99	15	15	11	11	13

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

Notes:

The annual mean concentrations are presented as $\mu g/m^3$.

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

All means have been "annualised" as per LAQM.TG22 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%).

Figure A.4 – Trends in Annual Mean PM_{10} Concentrations

Table A.7 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CM1	438928	557151	Kerbside		94	2	4	4	2	3
CM2	438116	554462	Urban Background		99	2	1	0	0	0

Notes:

Results are presented as the number of 24-hour periods where daily mean concentrations greater than 50µg/m^3 have been recorded.

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**.

If the period of valid data is less than 85%, the 90.4th 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.8 – Annual Mean $PM_{2.5}$ Monitoring Results ($\mu g/m^3$)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2022 (%) (2)	2018	2019	2020	2021	2022
CM2	438116	554462	Urban Background		99	8	9	6	6	8

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

Notes:

The annual mean concentrations are presented as $\mu g/m^3$.

All means have been "annualised" as per LAQM.TG22 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%).

Figure A.5 – Trends in Annual Mean $PM_{2.5}$ Concentrations

Appendix B: Full Monthly Diffusion Tube Results for 2022

Table B.1 – NO_2 2022 Diffusion Tube Results ($\mu g/m^3$)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted <0.70>	Annual Mean: Distance Corrected to Nearest Exposure	Comment
38	435714	552473	44.1	40.5	42.7	37.8	28.2	27.9	28.0	31.9	29.5	35.1	37.5	38.0	35.1	24.6	-	
53	438568	556566	32.7	23.3	34.3	30.5	21.6	18.5	20.8	25.4	31.2	16.3	37.6	34.3	26.9	18.8	-	
55	438690	556135	37.9	27.0			23.0	20.5	23.6	25.4	28.8	27.1	31.6	33.5	27.8	19.5	-	
56	439101	558292	30.3	23.1	36.7	19.8	18.6	22.4	23.4	27.9	25.4	27.3	32.6	28.0	25.9	18.1	-	
57	439664	557829			40.7	43.8		22.5	31.6		45.3		36.5	32.3	36.2	22.6	-	
58	432634	552616	36.2	27.6	32.7	27.0	20.4	21.5	22.7	22.4	32.1	29.7	35.6	33.5	28.3	19.8	-	
86	439466	556484	31.5	28.0	33.9	21.3	16.1	12.6	14.9	28.8	20.3	18.8	26.2	28.8	23.2	16.2	-	
88	439160	556995	28.8	25.6	38.7	31.5	24.4	22.2	27.6	26.9	35.6	28.2	39.3		29.5	20.7	-	
94	439374	556660	35.3	27.6	43.2	36.3	30.9	27.2	28.6	20.8	35.9	30.5	35.0	32.4	31.7	22.2	-	
100	438927	557151						24.3	26.7	29.5	29.7	32.7	32.8	33.9	30.2	20.4	-	
101	438116	554462	21.3	14.0	24.5	15.6	13.0	11.5	11.5	14.1	15.0	14.4		18.9	-	-	-	Triplicate Site with 101, 105 and 106 - Annual data provided for 106 only
105	438116	554462	20.0	14.2	24.4	14.4	13.0	11.4	12.2	14.1	14.4	13.2	14.9	18.8	-	-	-	Triplicate Site with 101, 105 and 106 - Annual data provided for 106 only
106	438116	554462	18.7	14.3	26.2	14.1	12.9	11.7	11.7	16.3	14.8	14.1	14.6	18.4	15.4	10.8	-	Triplicate Site with 101, 105 and 106 - Annual data provided for 106 only
109	439648	558120			29.9	26.6	18.7		19.4	22.3	31.5	17.3			23.2	16.1	-	
111	438453	555507	21.5	15.4	27.7	18.7	12.9	11.2	12.2	16.8	18.2	15.0		20.0	17.0	11.9	-	
113	437446	554989	34.9	22.0	36.0	26.7	21.4			24.2	29.9	26.3		33.0	27.8	19.4	-	
117	439495	556795	37.6	31.0	40.0	36.8	30.1	29.0	30.0	34.1	36.2	34.7	29.9	27.5	32.9	23.0	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted <0.70>	Annual Mean: Distance Corrected to Nearest Exposure	Comment
118	439696	557205	39.5	31.3	37.4	28.8	25.3	28.8	27.4		34.1	31.8	35.7	37.8	32.3	22.6	-	
119	439792	556921	31.3	22.9	31.1	24.3	18.7	19.4	21.7	22.1	25.1	26.2	29.9	29.3	25.0	17.5	-	
120	439806	557063			32.0	23.9	18.9	19.2	20.8	22.5	27.9	24.8		30.4	24.3	17.0	-	
121	440702	554722	27.8	19.2		18.8	15.6	14.1			22.8	18.0	22.1	22.8	20.0	14.0	-	
123	437943	556341			46.9	35.6	29.8	27.4	32.6	31.1	32.1	34.4	35.2	35.6	33.8	23.7	-	
125	435417	547025	24.5	21.9	35.1	31.7	17.7	15.9	19.5	22.8	25.9	20.5	26.0	26.0	23.8	16.6	-	
128	439707	557312	37.0	29.0	29.8	24.9	21.6	22.6	23.7	16.6	24.6	23.8	36.3	32.8	26.8	18.8	-	
129	439938	557089	26.3	19.5	24.7	15.3	12.2	11.9	13.1	15.8	19.0	18.9	25.8	27.7	19.1	13.4	-	
130	439538	557292	26.9	22.9	34.7	19.9	16.4	17.9	21.8	19.8	23.2	29.2	38.1	32.4	25.0	17.5	-	
132	439661	557901	50.1	42.3	49.1	42.4	35.0	36.9		21.0		47.0	47.7	47.3	41.9	29.3	-	
133	438123	558344			32.6	24.2	18.6	16.2	19.5	21.4	28.9	18.0	28.8	25.1	23.0	16.1	-	
134	438563	558517	36.6	25.3	40.2	29.9	26.1	27.2	26.9	30.2	36.7	23.6	33.5	30.0	30.0	21.0	-	
135	437561	557538			30.2	17.9	13.6	12.2	14.2	14.9	18.9	18.2	24.0	24.6	18.6	13.0	-	
136	428269	553809	22.9	17.1	22.4	17.6	10.8	11.7	12.9	16.1	19.5	16.1	19.2	22.6	17.3	12.1	-	
137	429935	556631	19.0	18.9	30.1	18.1	11.9	12.6	15.6	15.2	16.8	20.6	21.9	23.5	18.5	12.9	-	
138	429984	556576			47.0	40.6	28.7	29.9	31.4	36.9	39.2	34.9	34.8	35.4	35.6	24.9	-	
139	430899	556961	29.4			26.2	13.9	15.3	17.1	16.8	19.5	25.1	30.1	28.6	22.3	15.6	-	
140	430877	556851			30.3	22.4	11.7	9.8	12.8	16.8	17.9	17.7	23.0	23.3	18.4	12.9	-	
141	432542	549640	25.7			22.9	14.1	15.2	17.1	18.5	21.1	19.9	23.6	26.1	20.5	14.3	-	
142	437224	556714	31.3	27.0	45.6	29.3	27.0	26.6	29.6	28.3	28.5	32.0	38.0	34.6	31.1	21.8	-	

☒ **All erroneous data has been removed from the NO_2 diffusion tube dataset presented in Table B.1.**

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG22.**

☒ **Local bias adjustment factor used.**

☐ **National bias adjustment factor used.**

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

☒ **Sunderland City Council confirm that all 2022 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System.**

Notes:

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

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**.

See Appendix C for details on bias adjustment and annualisation.

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

New or Changed Sources Identified Within Sunderland City Council During 2022.

Sunderland City Council continues to assess new sources of pollution and during 2022 there were several new developments that were granted planning permission that had the potential to have an impact on air quality and have been subject to appropriate assessments.

A tyre recycling plant was given planning permission in January 2022. The plant will convert end of life tyres into useful commodities including biofuels and carbon black creating usable commodities rather than incineration. The site will be regulated by the Environment Agency and must comply with approved guidance and permit conditions setting out the best available techniques (BAT) for process operations and emission controls. It must achieve such standards in order to operate under an environmental permit. An Air Quality assessment was submitted in support of the planning application and process emissions were modelled using an appropriate AQ Model. The assessment predicted that the impact will be negligible at the nearest human receptors.

As reported in the 2022 ASR, a new link road was approved for construction. Construction of the Ryhope to Doxford Link Road (RDLR) is progressing with the second phase being completed in February 2023. A new footbridge was constructed that will allow pedestrians, cyclists and equestrian users cross the link road and hopefully encourage alternative modes of transport. The scheme is due to be completed this year.

There have been no new industrial processes in 2022 that have required an Environmental Permit.

Additional Air Quality Works Undertaken by Sunderland City Council During 2022.

Sunderland has not completed any additional works within the reporting year of 2022.

QA/QC of Diffusion Tube Monitoring

Sunderland City Council diffusion tubes are supplied and analysed by Gradko International Ltd, Winchester, Hampshire. The preparation method used is 20% TEA/ Water. Gradko are a UKAS accredited laboratory, and they also participate in several national quality schemes such as Air PT, LEAP and field intercomparison

Exposure of the diffusion tubes in line with the National Calendar was attempted wherever possible and for the vast majority of 2022 the National Calendar dates were followed.

Diffusion Tube Annualisation

3 non-automatic sites required annualisation. Annualisation is required for any site with data capture less than 75% but greater than 25%. The Diffusion Tube Processing Tool was used to calculate the factor and the annualisation summary is provided as Table C.2.

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

Site ID	Annualisation Factor Newcastle Cradlewell	Annualisation Factor Wesssington Way	Annualisation Factor Newcastle Centre	Annualisation Factor Silksworth	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean
57	0.9374	0.8612	0.9359	0.8332	0.8919	36.2	32.3
100	0.9441	0.9846	0.9854	0.9380	0.9630	30.2	29.1
109	0.9975	1.0193	1.0007	0.9437	0.9903	23.2	23.0

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2022 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.TG22 provides guidance with regard to the application of a bias adjustment factor to correct diffusion tube monitoring. Triplicate co-location studies can be used to determine a local bias factor based on the comparison of diffusion tube results with data taken from NO_x/NO_2 continuous analysers. Alternatively, the national database of diffusion tube co-location surveys provides bias factors for the relevant laboratory and preparation method.

Sunderland have applied a local bias adjustment factor of 0.7 to the 2022 monitoring data. A summary of bias adjustment factors used by Sunderland over the past five years is presented in Table C.22.

Sunderland also considered using the National Diffusion Tube Bias Adjustment Factor. A bias adjustment factor of 0.83 was obtained from the National Diffusion Tube Bias Adjustment Factor Spread sheet version v 03/23. Sunderland City Council have co located tubes in triplicate at CM2 which is an Urban Background site, and it was considered that

using a locally derived bias factor is more appropriate. The results from the Diffusion Tube survey once annualised and Bias adjusted did not exceed the objective when using either the local factor or the National factor.

Table C.2 – Bias Adjustment Factor

Monitoring Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2022	Local	<->	0.7
2021	National	03/21	0.84
2020	National	03/20	0.81
2019	National	03/19	0.93
2018	National	03/18	0.93

Table C.3 – Local Bias Adjustment Calculation

	Local Bias Adjustment Input 1	Local Bias Adjustment Input 2	Local Bias Adjustment Input 3	Local Bias Adjustment Input 4	Local Bias Adjustment Input 5
Periods used to calculate bias	12				
Bias Factor A	0.7 (0.58 - 0.88)				
Bias Factor B	43% (14% - 71%)				
Diffusion Tube Mean (µg/m^3)	15.6				
Mean CV (Precision)	3.3%				
Automatic Mean (µg/m^3)	10.9				
Data Capture	99%				
Adjusted Tube Mean (µg/m^3)	11 (9 - 14)				

Notes:

A single local bias adjustment factor has been used to bias adjust the 2022 diffusion tube results.

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been estimated using the Diffusion Tube Data Processing Tool/NO_2 fall-off with

distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1.

Table C.4 – NO_2 Fall off With Distance Calculations (concentrations presented in µg/m^3)

Fall off with distance calculations have not been completed at any site in Sunderland during 2022.

QA/QC of Automatic Monitoring

The QA/QC procedures of Sunderland are based on the AURN Site Operator's manual along with training received from our original equipment suppliers, Casella Measurement. Refresher training is provided by the AURN when required for the sites that Sunderland act as LSO or at our affiliate site.

The fundamental aims of a quality assurance/ control programme are:

- The data obtained from measurement systems should be representative of ambient concentrations existing in each area.
- Measurements must be accurate, precise and traceable.
- Data must be comparable and reproducible.
- Results must be consistent over time.

An appropriate level of data capture is required throughout the year.

Equipment Maintenance

- Automatic analysers are serviced every 6 months by a qualified engineer under a contract with Matts Monitors
- Local Authority staff visits the air quality sites at least once every 2 or 4 weeks during which a check of the equipment is made to ensure it is all working within normal parameters. Filters are also changed during this visit.
- If a problem occurs, then a call-out is instigated to the service centre and an engineer will normally visit site within 48-hours to correct the fault.

Calibration

- At each site visit staff will perform a calibration response check using a certified gas cylinder. Results are passed to our data management partner to adjust data if necessary.
- At the 6-month service the instruments are re-calibrated to the site cylinder certificated value.
- Gas cylinder pressures are regularly checked at routine visits to ensure they are replaced before they run out completely.
- When a cylinder is replaced, the new certified values are recorded and forwarded to the data management team.

Data Validation

During 2022 the contract for data capture has been performed by WeCare4Air, who now host Sunderland's data at Air Quality Service and Data throughout the UK - We Care 4 Air. We Care 4 Air have continued the excellent work of AQDM and follow the same methods as outlined below.

Review data daily to ensure that

- Telecommunications to the station are operational
- The air quality station is operational
- Individual analysers are operational
- Air quality exceedances are identified
- Operational information such as TEOM filter loading, does not invalidate data
- Obvious data errors are identified

Data Ratification

In addition to the initial data screening process (validation), data are further scrutinised in monthly blocks in order to provide a final ratified data set.

The software that collects the data is used to rescale the data using the factor calculated from the monthly/ fortnightly calibration check. Data is then reviewed for erroneous data such as:

- Daily calibration spikes
- Routine or service visit errors
- Analyser faults
- Site faults, such as power outages

When data is satisfactory, it is compared to other local sites. This provides a check to ensure data is realistic.

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

The data from CM1 (Trimdon Street) was collected using a TEOM and PM_{10} monitoring data collected was previously corrected using the Volatile Correction Model (VCM). This calculation is carried out by the data management company prior to it being completed into the final ratified data set. The removal of a nearby FDMS analyser has meant that there is no longer an analyser in range and the correction model cannot be used. After seeking advice from the LAQM helpdesk, the data was corrected using a factor of 1.3 but it cannot be relied heavily upon to make conclusions.

Automatic Monitoring Annualisation

All automatic monitoring locations within Sunderland recorded data capture of greater than 75% therefore it was not required to annualise any monitoring data. In addition, any sites with a data capture below 25% do not require annualisation.

NO_2 Fall-off with Distance from the Road

Wherever possible, monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure has been estimated using the NO_2 fall-off with distance calculator available on the LAQM Support website. Where appropriate, non-automatic annual mean NO_2 concentrations corrected for distance are presented in Table B.1. No automatic NO_2 monitoring locations within Sunderland required distance correction during 2021.

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

Figure D.1 – Map of CM 1 and Diffusion Tube 88 Site

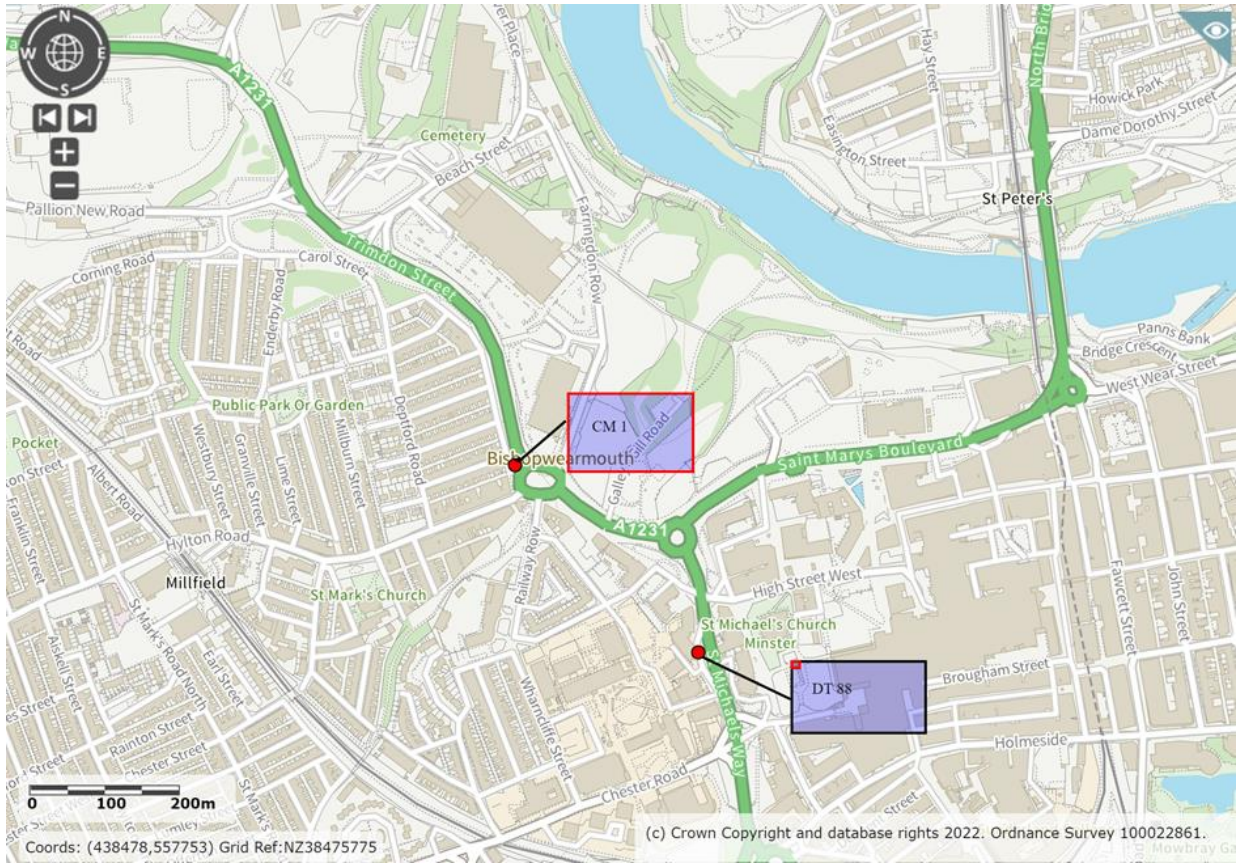

Figure D.2 – Map of CM 2 and Diffusion Tubes 101, 105 & 106

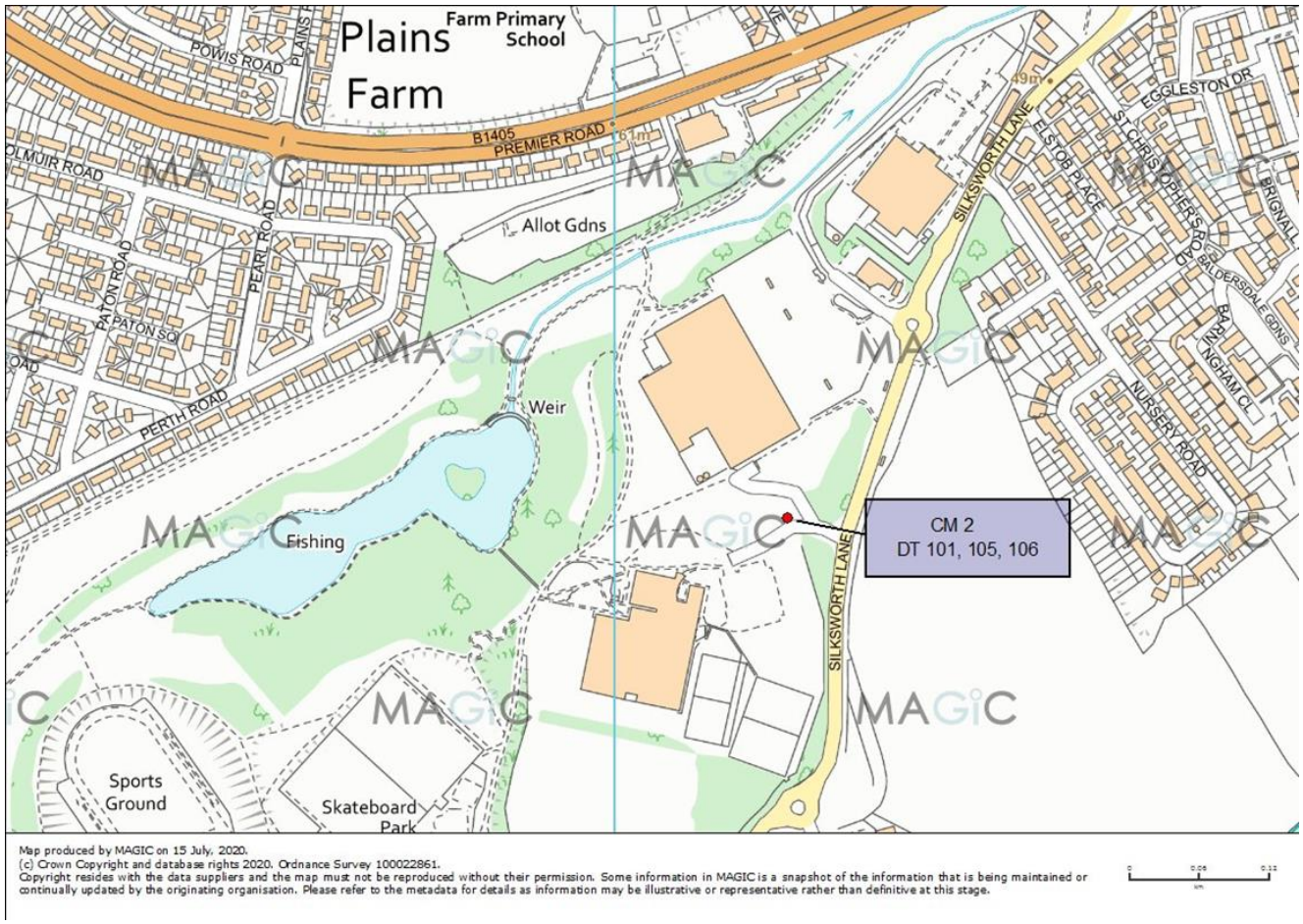

Figure D.3 – Map of CM 3 and Diffusion Tubes 133 & 134

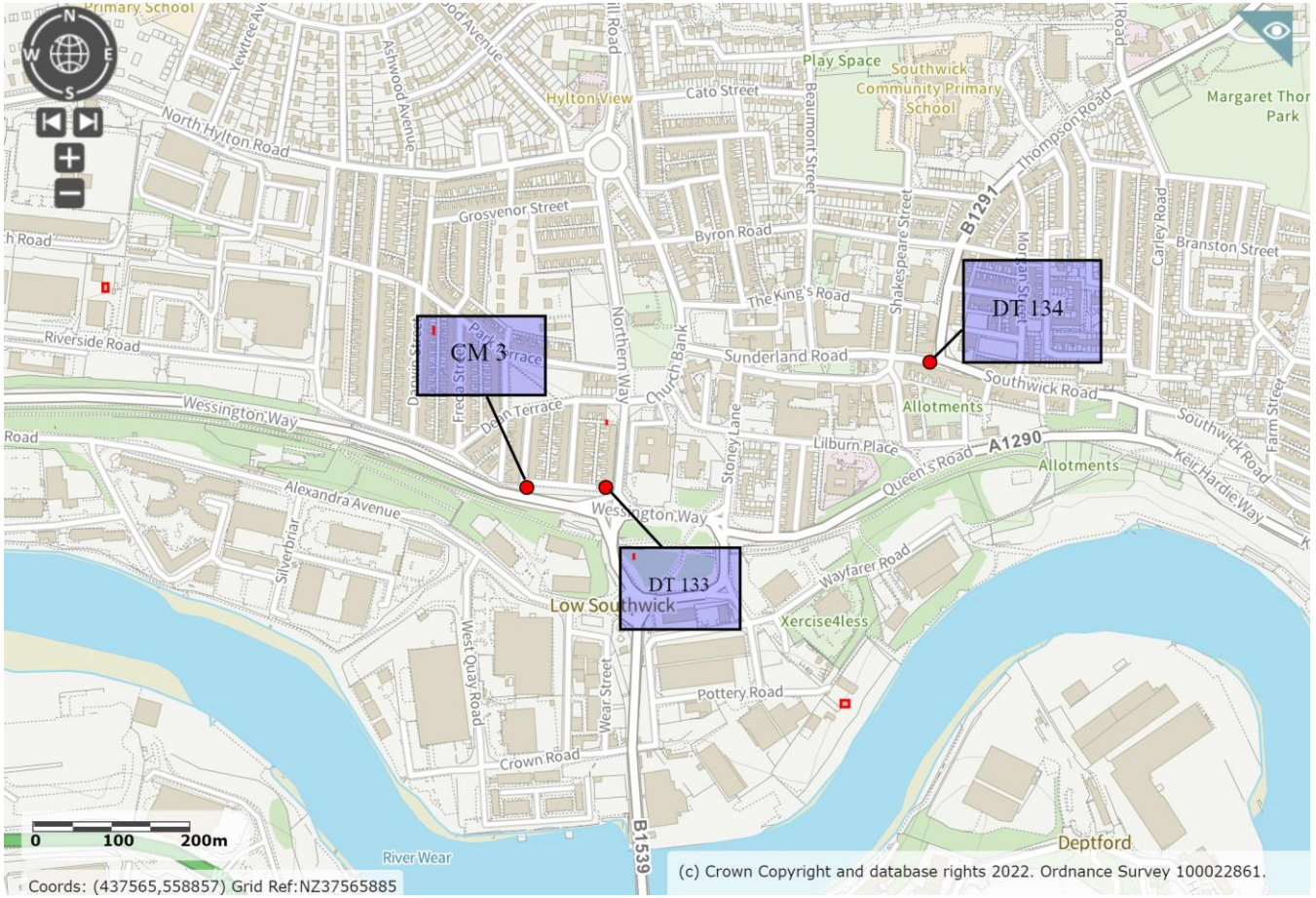

Figure D.4 – Map Diffusion Tube 135

Figure D.5 – Map of Diffusion Tubes 53

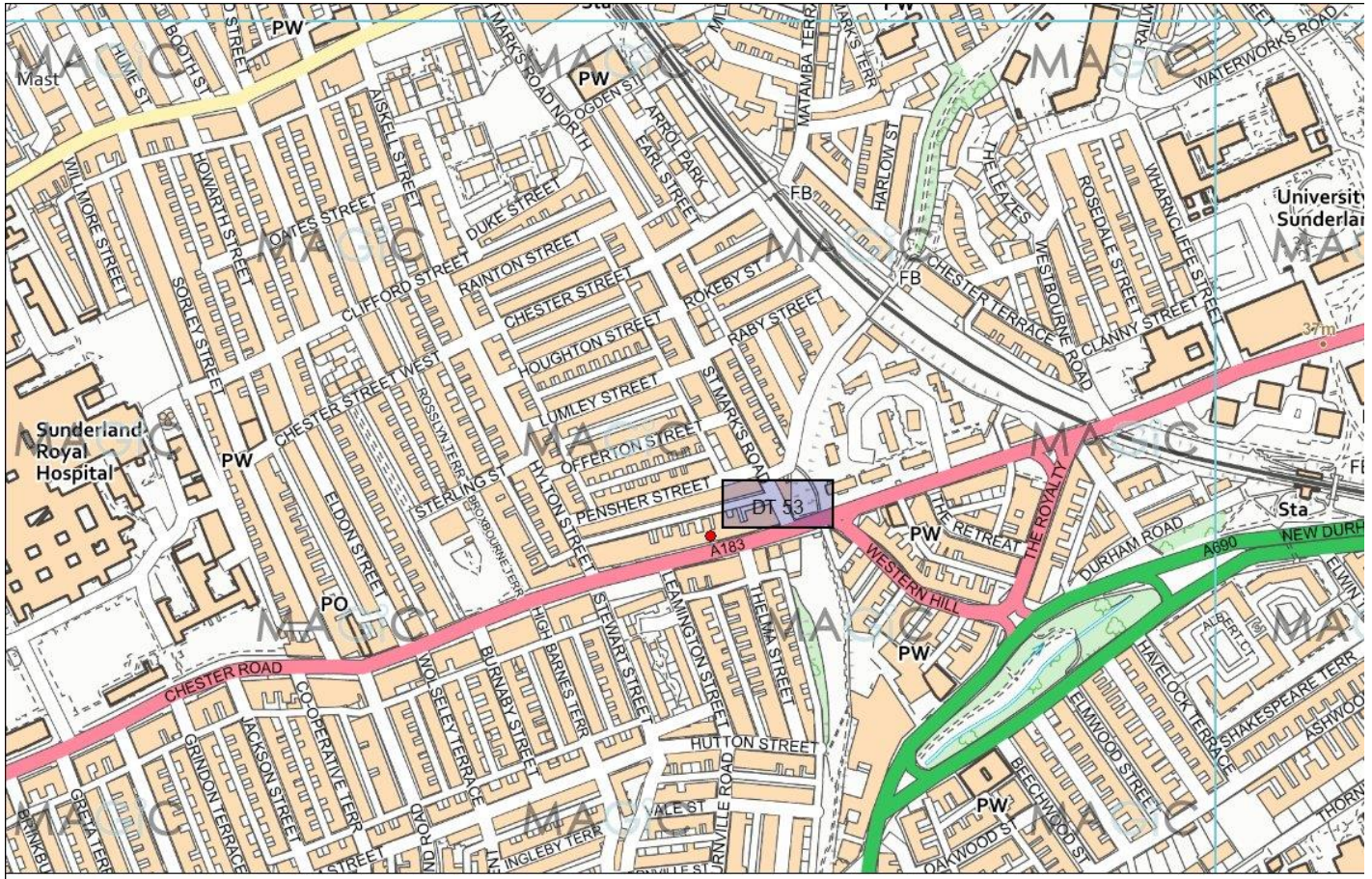

Figure D.6 – Map of Diffusion Tube 55

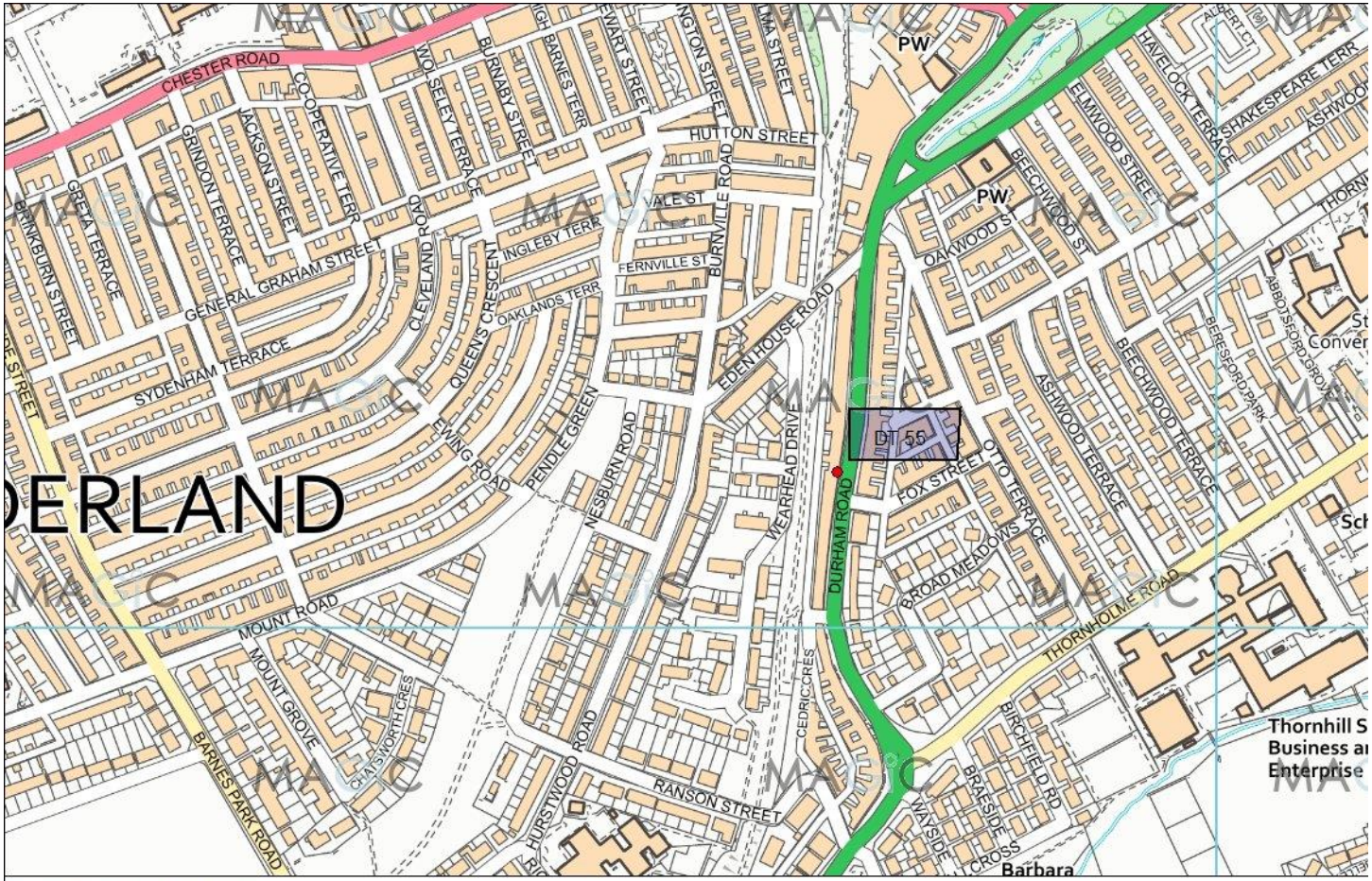

Figure D.7 – Map of Diffusion Tubes, 56, 57, 109 & 132.

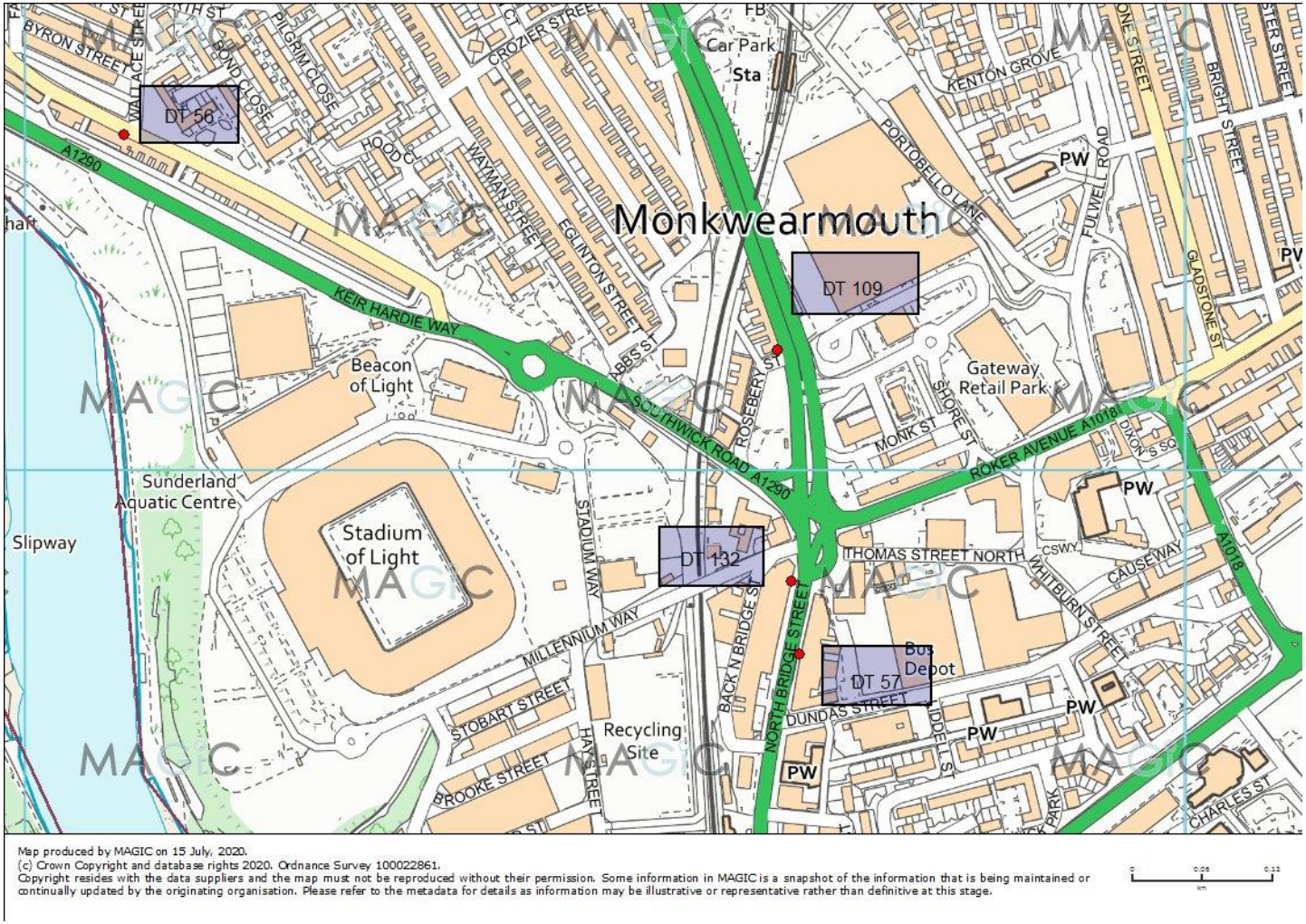

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Figure D.8 – Map of Diffusion Tube 58

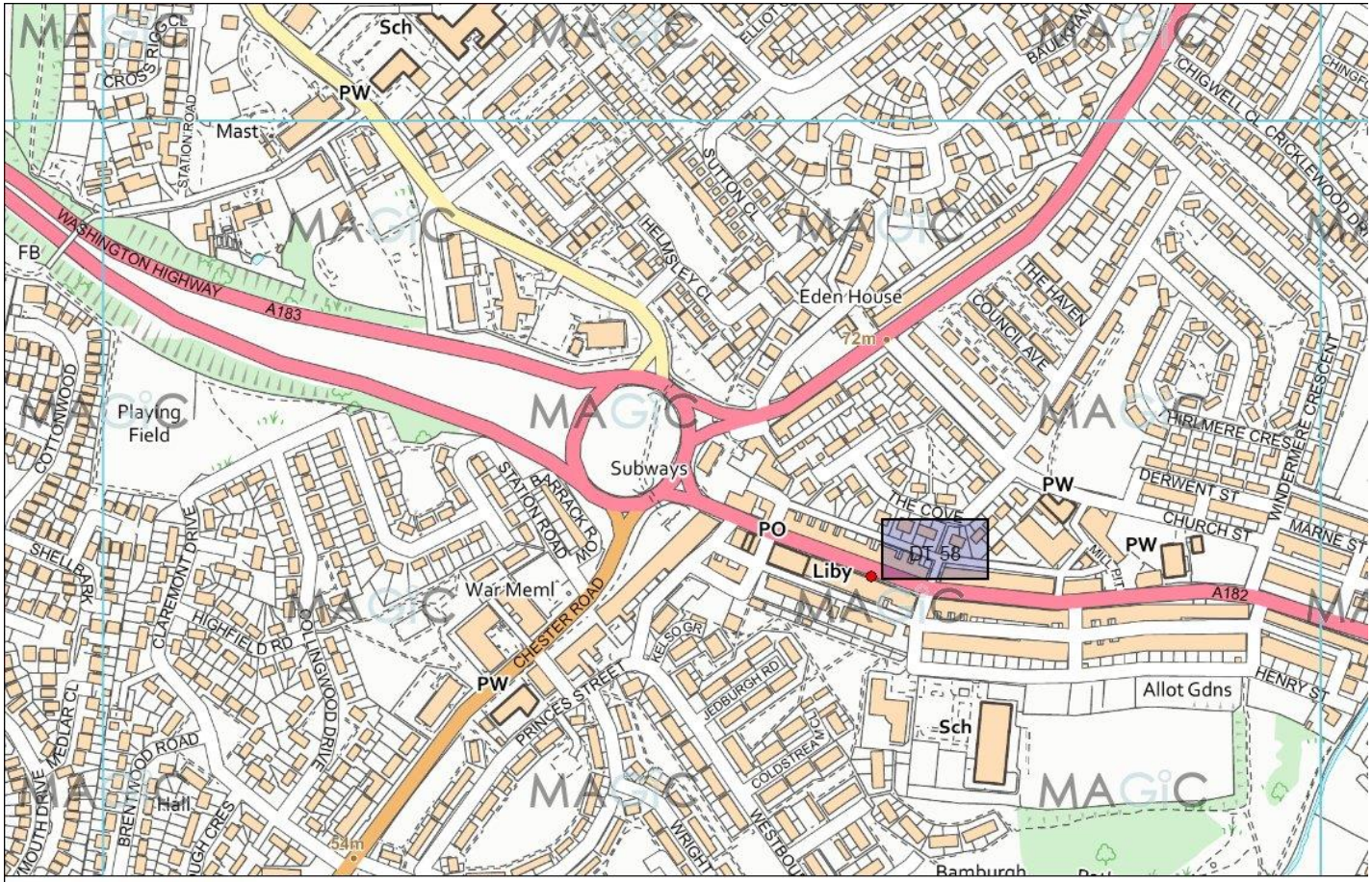

Figure D.9 – Map of Diffusion Tubes 86, 88, 94 & 117

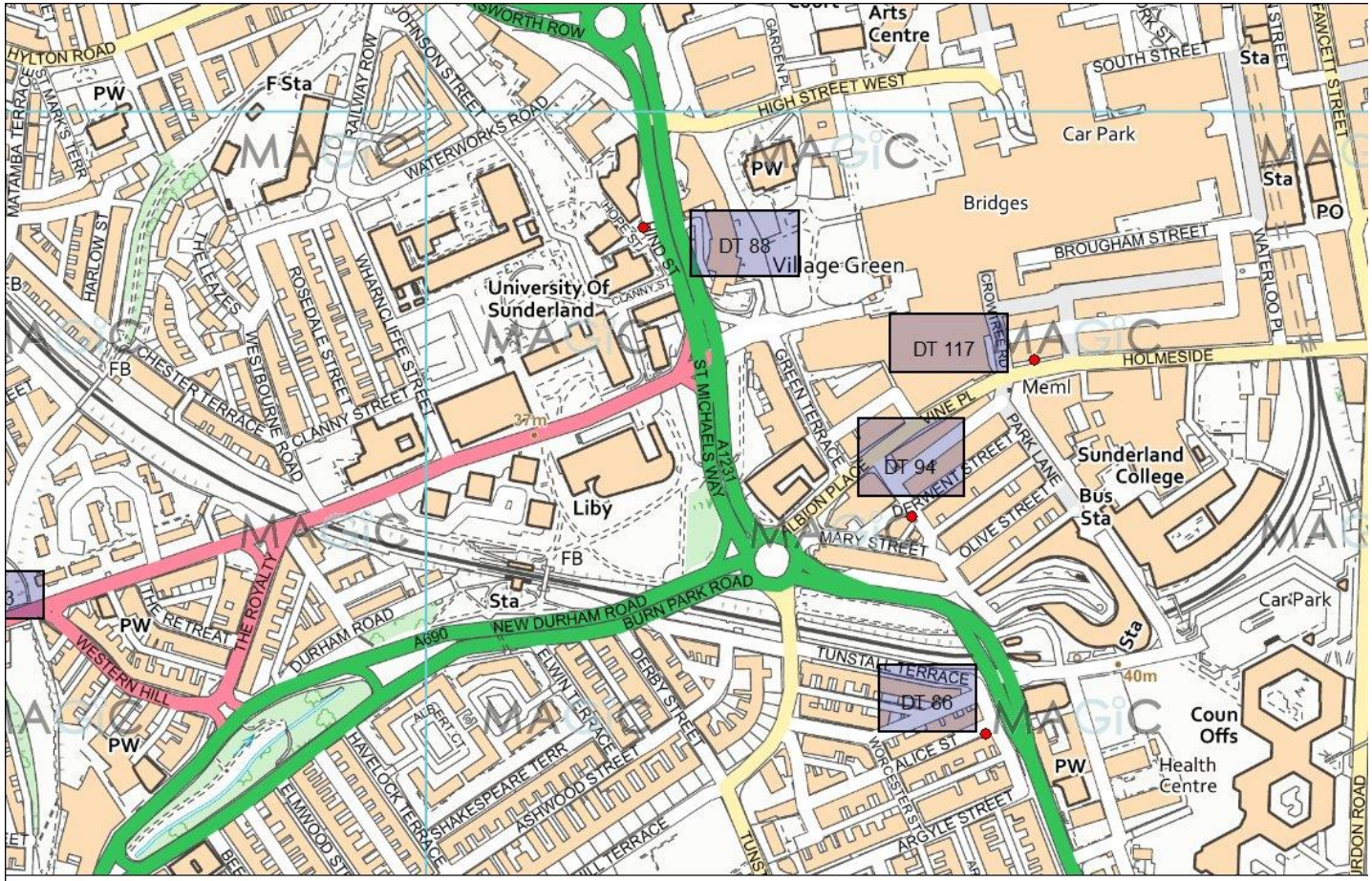

Figure D.10 – Map of Diffusion Tube 111

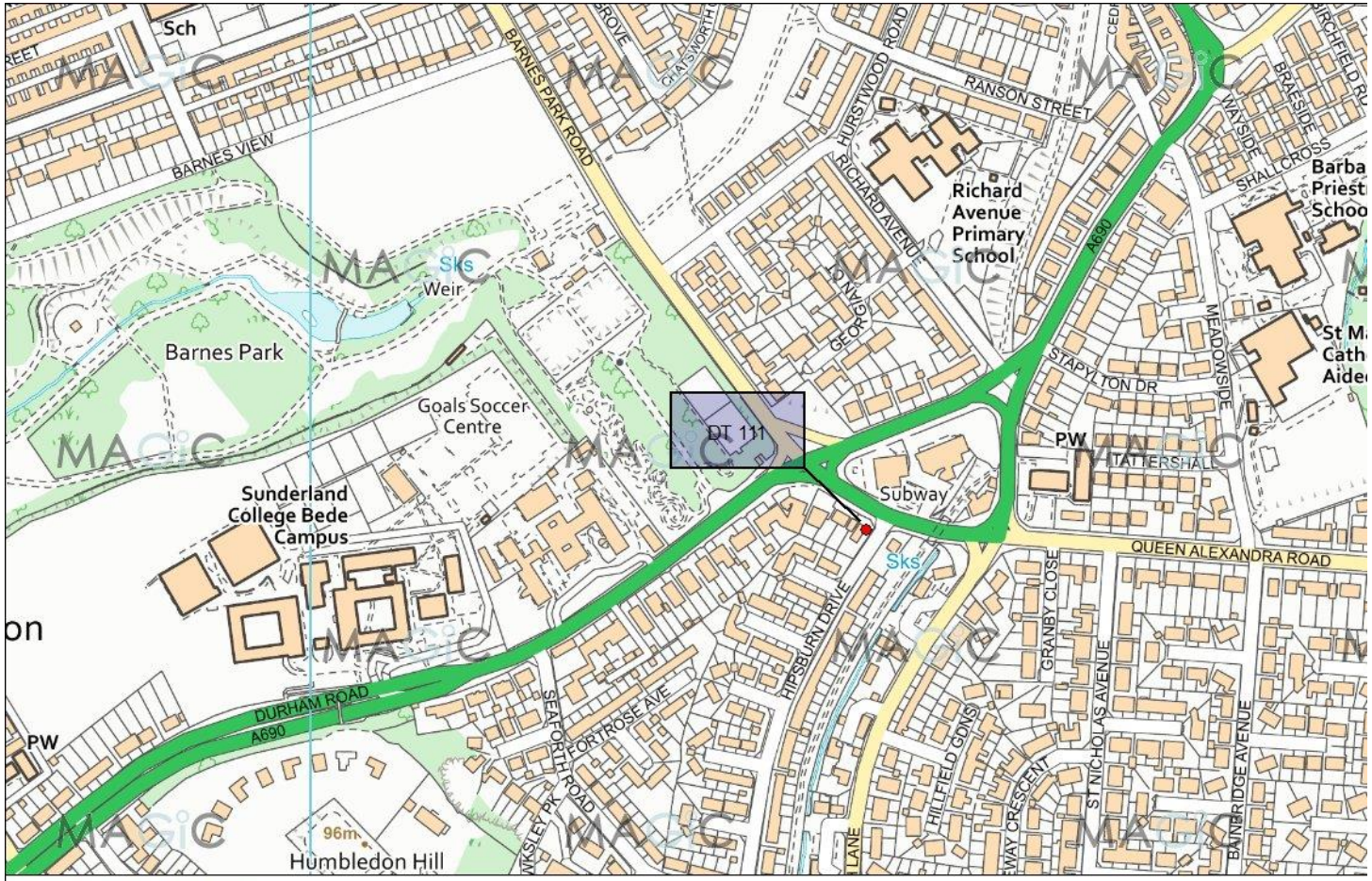

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Figure D.11 – Map of Diffusion Tube 113.

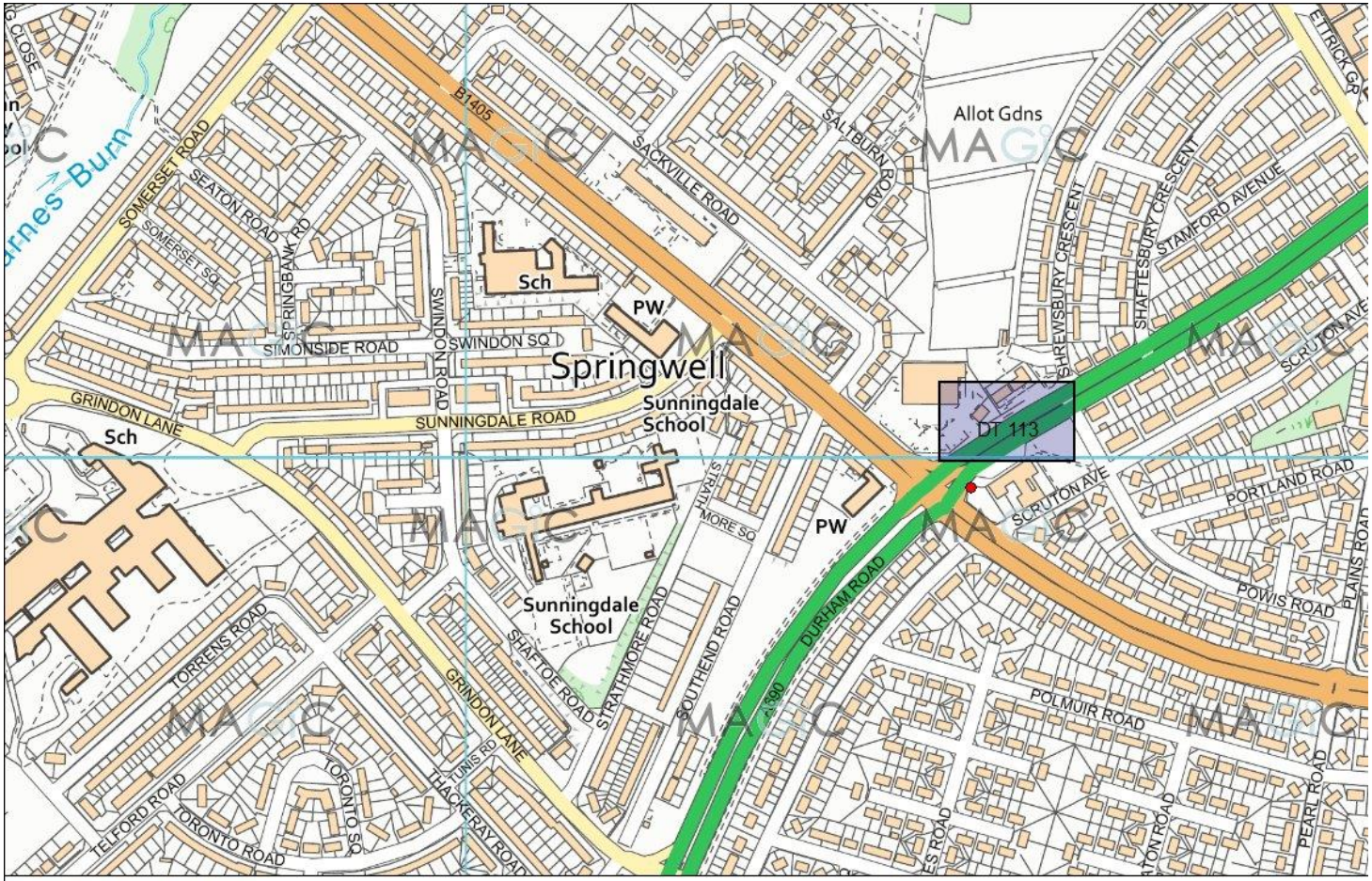


Figure D.12 – Map of Diffusion Tubes 118, 128 & 130

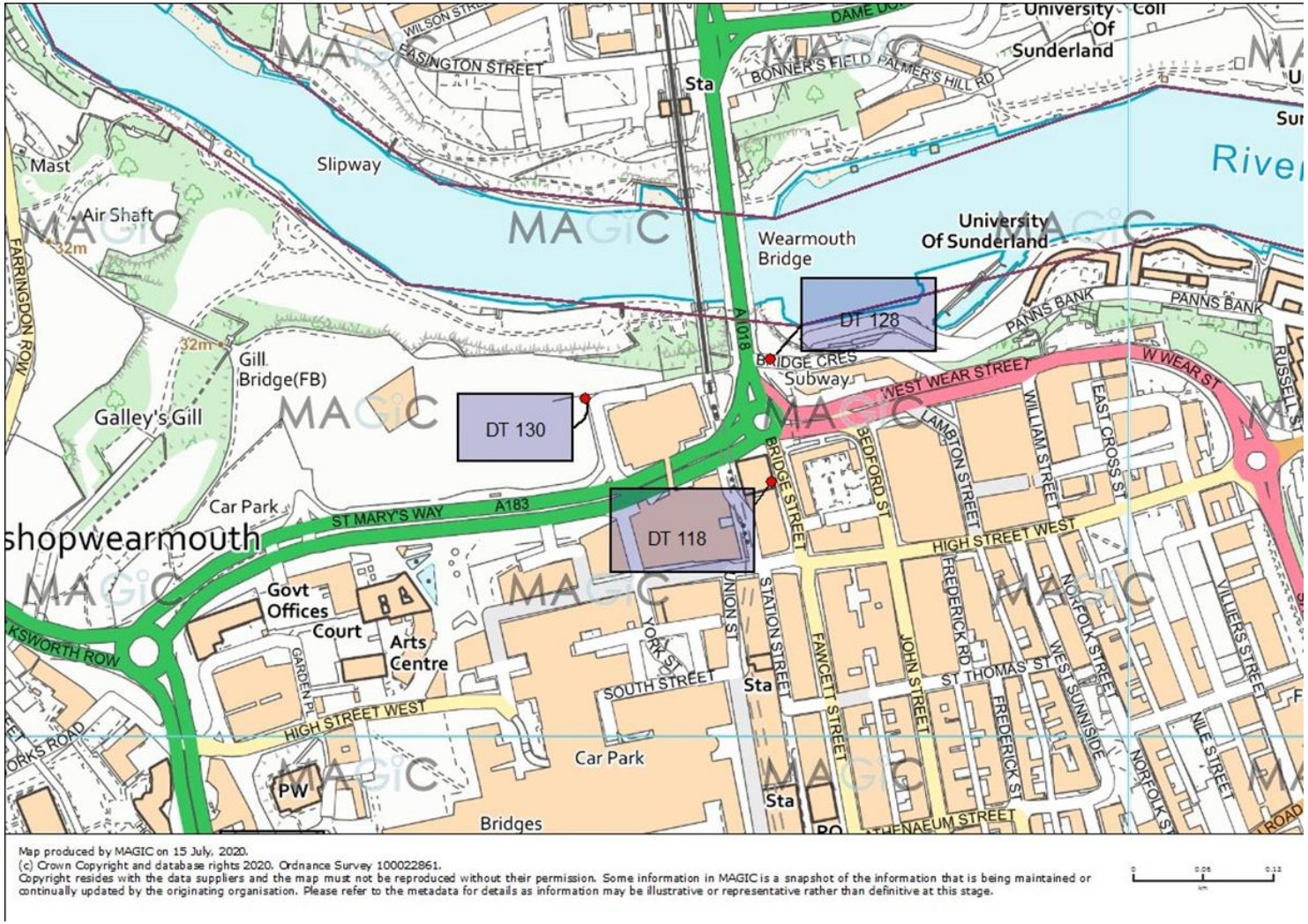


Figure D.13 – Map of Diffusion Tube 121

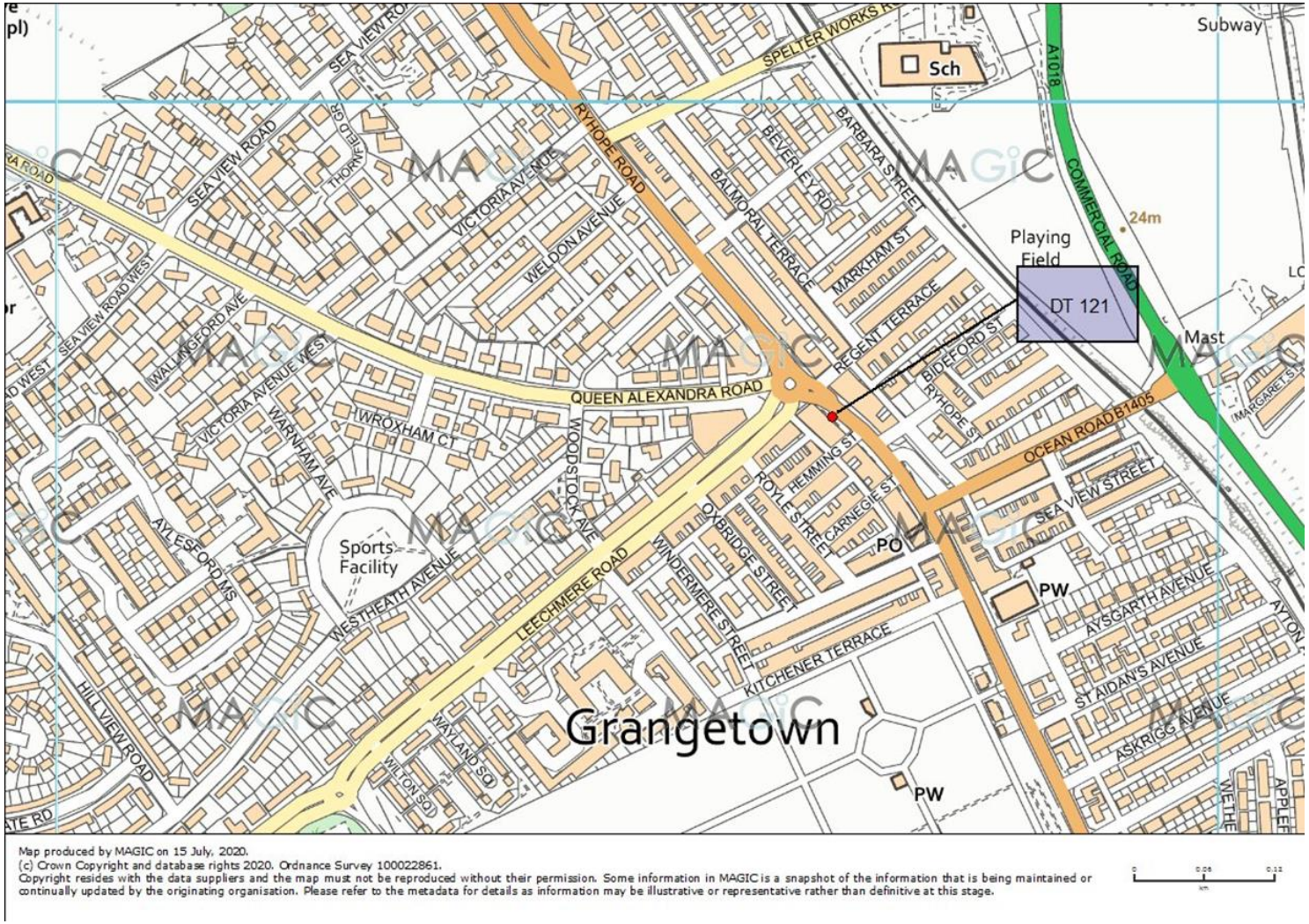


Figure D.14 – Map of Diffusion Tube 123 and 142.

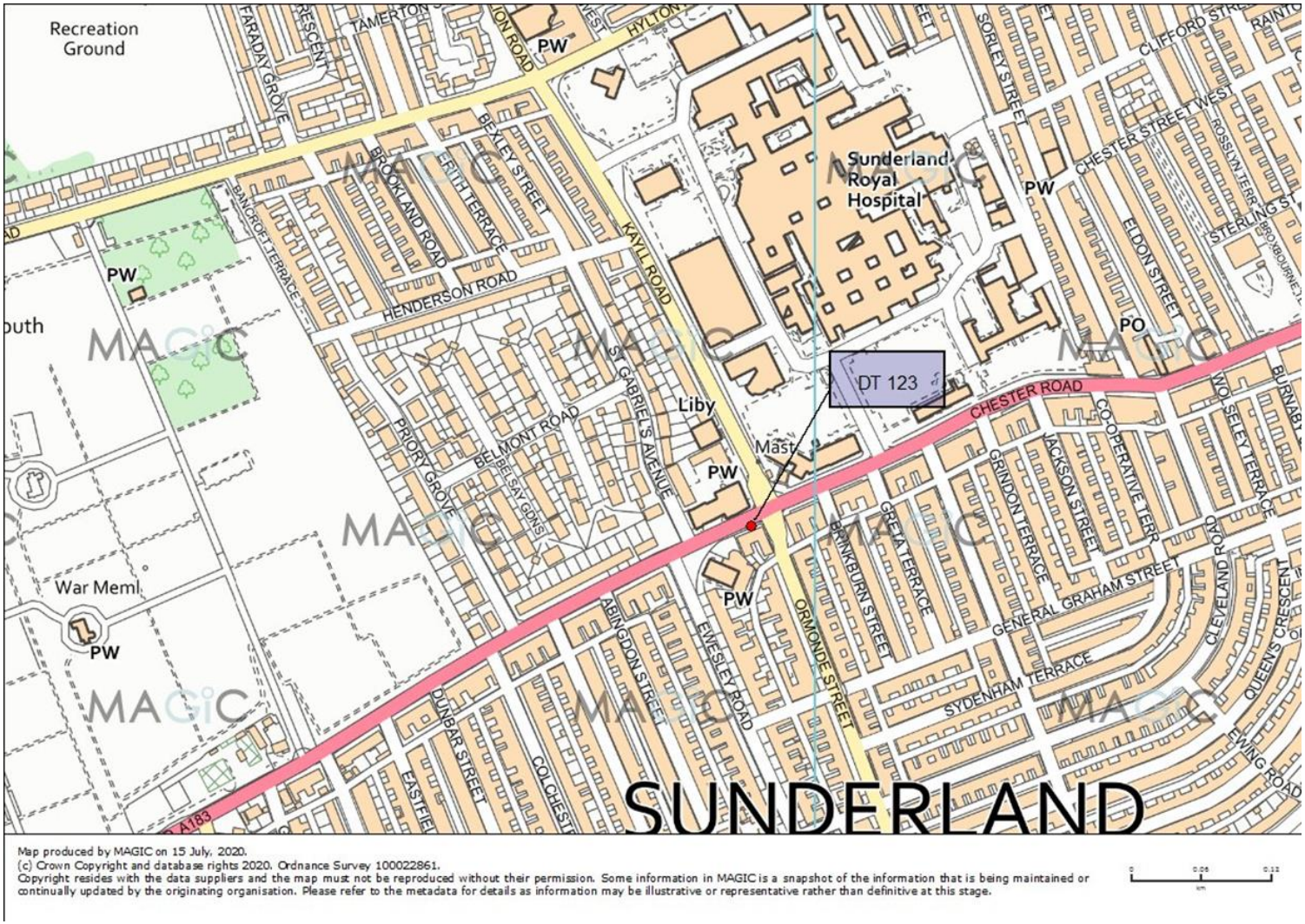


Figure D.15 – Map of Diffusion Tube 125

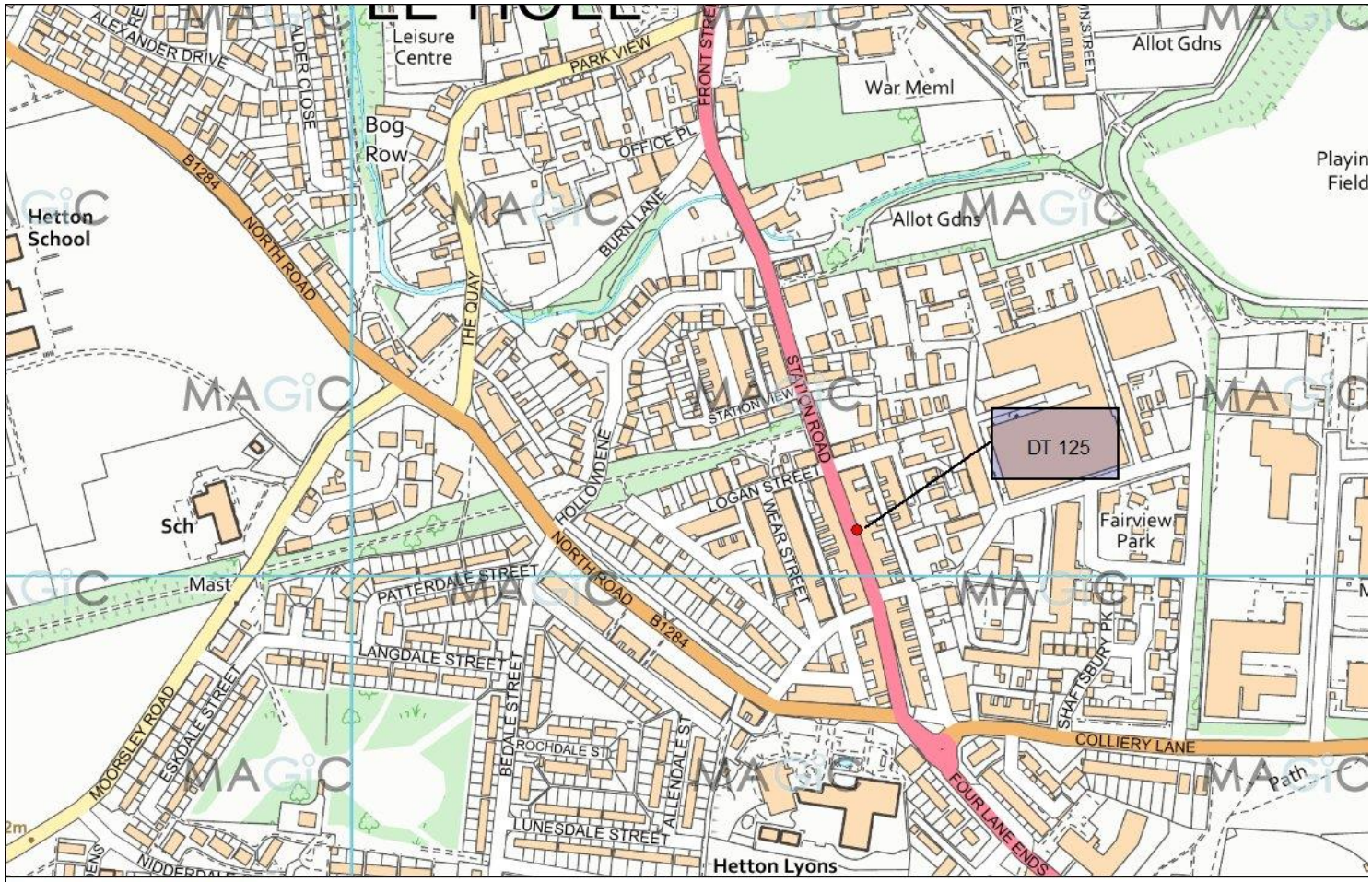


Figure D.16 – Map of Diffusion Tubes 136

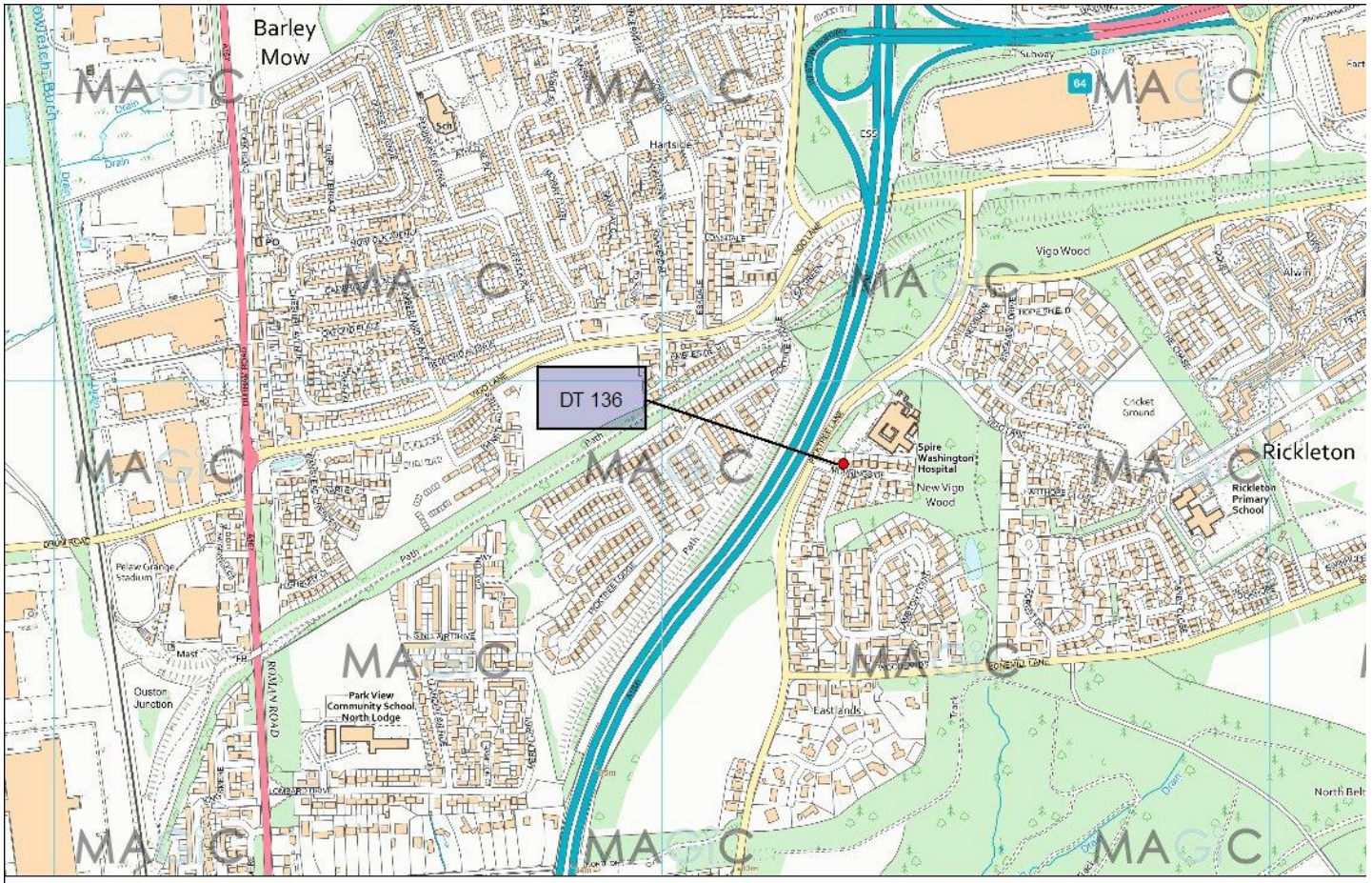


Figure D.17 – Map of Diffusion Tubes 137, 138, 139 & 140.

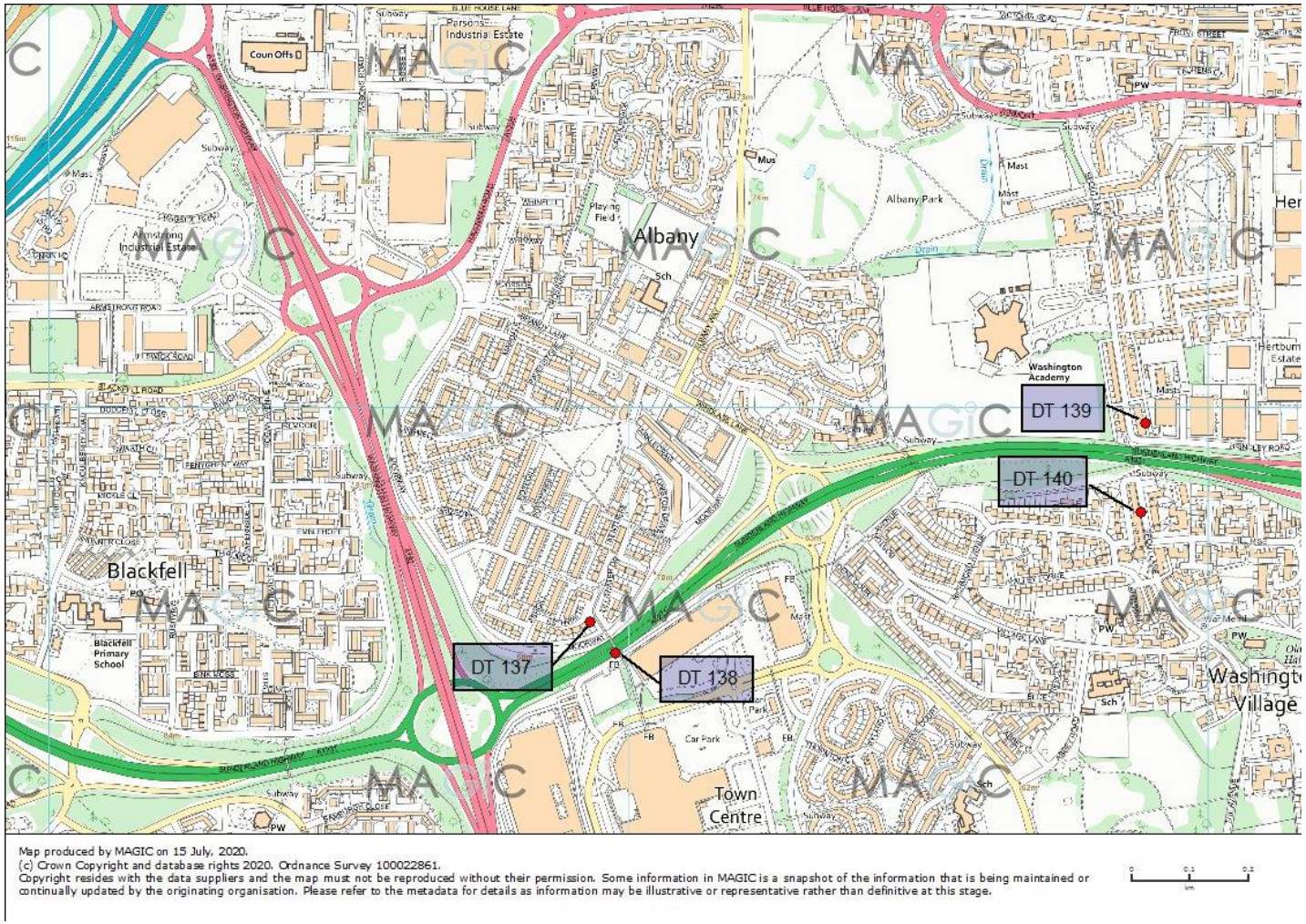
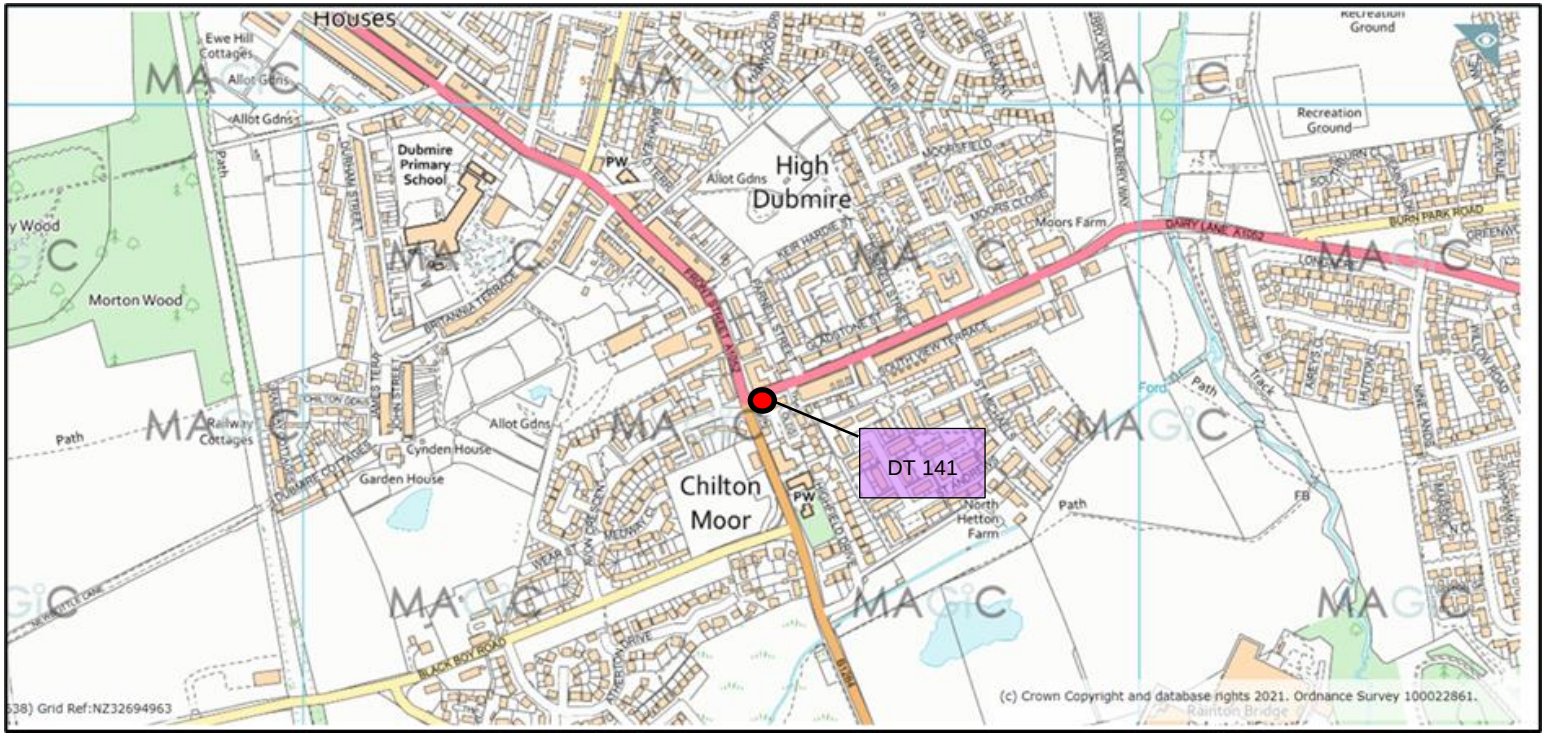


Figure D.18 – Map of Diffusion Tube 141.



Appendix E: Summary of Air Quality Objectives in England

Table E.1 – Air Quality Objectives in England[7]

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

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

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	Annual Status Report
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by National Highways
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 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

References

- Local Air Quality Management Technical Guidance LAQM.TG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.
- Local Air Quality Management Policy Guidance LAQM.PG22. August 2022. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.