2020/2021 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

September 2021

Cheshire West and Chester

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Executive summary: Air quality in our area

Air quality in Cheshire West and Chester

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 28,000 to 36,000 deaths at typical ages[3], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[4].

This annual status report (ASR) covers monitoring results for 2019 and 2020 and action that the Council is taking in a bid to improve local air quality.

In Cheshire West and Chester (CWCC) the main pollutants of concern are nitrogen dioxide (NO_2), particulate matter (PM) and sulphur dioxide (SO_2).

National government has set health-based objectives for a range of pollutants and, where these are not met, the local authority must declare an air quality management area (AQMA) and commit to improving local air quality through action planning. There are four designated AQMAs in the borough. Three of these, located in Chester, Ellesmere Port and Frodsham relate to exceedances of the annual mean NO_2 objective due to road traffic. The fourth, in Thornton-le-Moors, was declared because of exceedances of the 15-minute mean SO_2 objective caused by industrial emissions. Details of the AQMAs and associated action plans (AQAPs) can be found on the Council website at www.cheshirewestandchester.gov.uk/aqmanagement .

[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, July 2020

[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

In 2019 the NO_2 annual average objective was exceeded at a number of locations in the Chester city centre AQMA. Reduced traffic levels during the lockdown in 2020 however meant that no exceedances were recorded last year. Data from 2019 indicates that the objective was not exceeded at residential properties in the AQMAs in Frodsham and Ellesmere Port. National air quality objectives for PM_{10} (particulate matter less than 10 micrometres in diameter) are complied with in Cheshire West and Chester. There is currently no regulatory standard applied to $PM_{2.5}$ (particulate matter less than 2.5 micrometres in diameter) for local authorities, but European Union (EU) limit values have been set as there are well-documented associations with health effects. Local data suggests that $PM_{2.5}$ levels at background sites are well below the limit value.

At our long-term monitoring sites there is a discernible downwards trend in NO_2 and PM_{10} concentrations over time. It is not possible to derive significant trends in the data from SO_2 monitoring stations, but this is not unexpected due to the episodic nature of the exceedances.

As a unitary authority, Cheshire West and Chester Council enjoys the benefit of close inter-departmental working with all disciplines that may have an interest in and influence over local air quality matters. Externally, effective lines of communication have been established between CWCC and the Environment Agency, which is particularly important in respect of the air quality AQAP for Thornton-le-Moors.

Actions to improve air quality

Whilst air quality has improved significantly in recent decades and will continue to improve due to national policy decisions, there are some areas where local action is needed to improve air quality further.

The 2019 Clean Air Strategy[5] sets out the case for action, with goals even more ambitious than EU requirements to reduce exposure to harmful pollutants. The Road to Zero[6] sets out 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

[5] Defra. Clean Air Strategy, 2019

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

Areas (AQMAs) are designated due to elevated concentrations heavily influenced by transport emissions.

In the past year, Cheshire West and Chester Council has installed numerous electric car charging points (EVCPs), both in the public realm and at Council depots. The current network will allow up to 62 vehicles to charge simultaneously but it is hoped that the number of EVCPs will increase significantly over the next few years to enable people to switch to zero emission vehicles. Transition to electric vehicles has also been encouraged through the use of planning conditions for new developments and this is expected to continue with the forthcoming publication of a revised parking standards document.

Following declaration of a Climate Emergency in May 2019 the Council have been working and engaging with a range of partners, climate experts, community groups and businesses to understand the challenges and opportunities the Climate Emergency presents for our area. A Climate Emergency Fund (CEF) has been established to support a range of low carbon projects and, where there are co-benefits, projects that seek to improve local air quality. The rapid electric car chargers at the Boat Museum were supported by both CEF and Local Enterprise Partnership (LEP) funding.

Conclusions and priorities

No exceedances of the NO_2 and PM_{10} objectives were identified outside any existing AQMAs in 2019 and 2020. In 2020, because of the impact of national lockdown on road traffic flows, no exceedances of the NO_2 objectives were observed within the AQMAs. In both 2019 and 2020 the 15-minute SO_2 was not exceeded in the Thornton-le-Moors AQMA.

Long-term monitoring data shows a noticeable reduction in NO_2 levels over time, particularly at roadside sites. Monitoring results in the Ellesmere Port AQMA have been consistently below the air quality objective for NO_2 and we intend to revoke the AQMA. Also the status of the Frodsham AQMA needs to be reviewed.

Publication of the finalised action plan for the Chester AQMA is imminent, although a number of measures from the draft AQAP have been progressed successfully in the last 18-24 months. Further AQAP measures, as well as measures from the Low Emission Strategy, will be required to bring forwards compliance in coming years.

In the coming year, the Council's priorities are to publish the Air Quality Action Plan for Chester; make progress with measures in the LES; complete and adopt the EV strategy; expand the availability of EVCPs in the borough; revoke the AQMA in Ellesmere Port; review

the status of the AQMA in Frodsham, adoption of a revised taxi Licensing policy (currently under consultation), continue to lead by example and expand the number of ultra-low emission vehicles within the council fleet and take advantage of funding opportunities for the adoption of further air quality improvement measures.

Local engagement and how to get involved

There are many ways that we can all help to reduce outdoor air pollution:

- Leave your car at home and walk, cycle or use public transport instead. Car drivers can be exposed to significantly more air pollution than pedestrians or cyclists using the same streets
- When choosing your next car, consider alternatives to petrol and diesel such as electric cars or plug-in hybrids. Tailpipe emissions from these vehicles are much lower (or even zero) and running costs are significantly cheaper. Lease costs of electric cars are often similar to an equivalent petrol/diesel model, road tax is zero and the benefit in kind (BIK) tax cost is a fraction of that for traditional models.
- Switch your car's engine off whenever you're not moving and it's safe to do so. You'll improve air quality for yourself and others
- Keep your car regularly serviced and the tyres correctly inflated
- Adopt an efficient driving style – anticipate the road ahead, change up the gears earlier and brake smoothly. It could save you a lot of money over the course of a year
- Burning wood and other solid fuels produces a lot of air pollutants. If you do intend to buy a wood-burning stove, choose a Department for Environment, Food and Rural Affairs (Defra) approved Eco-Design Ready model. Make sure that the wood you use meets the 'Woodsure ready to burn' requirements (seasoned dry wood with moisture content below 20%).
- Compost your garden waste or use green wheelie bins rather than burning it

Adults and children with lung problems and adults with heart problems may be particularly affected by air pollution. Information on local air quality is available on the Council's website www.cheshirewestandchester.gov.uk/airquality and further information on forecasting and health advice is available on Defra's UK-air website https://uk-air.defra.gov.uk/ .

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1 Local air quality management

This report provides an overview of air quality in Cheshire West and Chester during 2019 and 2020. It fulfils the requirements of Local Air Quality Management (LAQM) as set out in Part IV of the Environment Act (1995) and the relevant Policy and Technical Guidance documents.

The LAQM process places an obligation on all local authorities to regularly review and assess air quality in their areas, and to determine whether or not the air quality objectives are likely to be achieved. Where an exceedance is considered likely the local authority must declare an Air Quality Management Area (AQMA) and prepare an Air Quality Action Plan (AQAP) setting out the measures it intends to put in place in pursuit of the objectives. This Annual Status Report (ASR) is an annual requirement showing the strategies employed by Cheshire West and Chester 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 23.

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 12 months setting out measures it intends to put in place in pursuit of compliance with the objectives.

A summary of AQMAs declared by Cheshire West and Chester Council can be found in Table 1. The table presents a description of the four AQMAs that are currently designated within Cheshire West and Chester. Note, the 'current year' used for the level of exceedance is 2020 for the industrial site but for the traffic-related sites, 2019 data has been used due to suppressed traffic flows during lockdown. Appendix D: Map(s) of monitoring locations and AQMAs provides maps of AQMAs and also of the air quality monitoring locations in relation to the AQMAs. The air quality objectives pertinent to the current AQMA designations are as follows:

- NO_2 annual mean
- SO_2 15-minute mean

We propose to revoke Whitby Road / Station Road AQMA in Ellesmere Port and review the status of Fluin Lane AQMA in Frodsham (see 3.1.3).

Table 1 - Declared air quality management areas

AQMA name	Date of declaration	Pollutants and air quality objectives	One line description	Is air quality in the AQMA influenced by roads controlled by highways England?	Level of exceedance: declaration	Level of exceedance: current year	Name and date of AQAP publication	Web link to AQAP
Chester city centre	May-17	NO_2 Annual Mean	Inner ring road and sections of Liverpool Rd, Parkgate Rd, Hoole Way, Boughton gyratory and Watergate St. Chester	No	50.3µg/m^3 (T6)	43.9µg/m^3 (C36, 2019)	Chester city centre air quality action plan (draft) 2019	www.cheshirewestandchester.gov.uk/aqmanagement
Thornton-le-Moors	Sep-16	SO_2 15-minute mean	An area around the oil refinery at Stanlow	No	56 exceedances (TLM)	21 exceedances (TLP, 2020)	Thornton-le-Moors air quality action plan 2018	
Fluin Lane	Nov-15	NO_2 annual mean	Junction of A56 and Fluin Lane, Frodsham	No	41.5µg/m^3 (FJ)	36.9µg/m^3 (FJ, 2019)	Frodsham air quality action plan 2018	
Whitby Road / Station Road	May-05	NO_2 annual mean	Residential properties on parts of Whitby Rd, Station Rd and Princes Rd, Ellesmere Port	No	44.5µg/m^3 (SK)	35.0µg/m^3 (WH, 2019)	Ellesmere Port and Neston BC air quality action plan 2007	

☒ Cheshire West and Chester confirm the information on UK-Air regarding their AQMA(s) is up to date.

☒ Cheshire West and Chester confirm that all current AQAPs have been submitted to Defra.

Progress and impact of measures to address air quality in Cheshire West and Chester

Defra's appraisal of the 2019 ASR concluded that "on the basis of the evidence provided by the local authority the conclusions reached are acceptable for all sources". The appraiser's comments were:

- Trends are clearly presented and discussed and a robust comparison with air quality objectives is provided.
- The diffusion tube and AQMA mapping is comprehensive and clearly demonstrates the monitoring network.
- The council is considering the revocation of the Ellesmere Port (Whitby Road / Station Road) AQMA following another year of compliance with the objectives. Updates on any detailed assessment and progress on this should be included in next year's ASR.
- The Council is planning to publish the AQAP for the Chester City Centre AQMA in 2019. Progress made with this should be included in next year's ASR.
- QA/QC of the data was considered to be thorough, with annualisation of data carried out at one site, a national bias adjustment factor used for the non-automatic network and distance correction performed where required.
- The report included measures to address $PM_{2.5}$ and links to the Public Health Outcomes Frameworks. This is encouraged to be continued in future ASRs.
- Clear priorities for 2019 were identified, which is welcomed. Progress made on these priorities should be reported on in next year's report.
- Comments from the previous appraisal have been included and addressed, which is welcomed.

It was noted that the Council was considering revocation of the AQMA in Ellesmere Port. This action has not progressed since publication of the 2019 ASR but as noted in this current report, the matter will be revisited.

The AQAP for Chester was planned to be published in 2019. Unfortunately, publication was delayed due to staffing levels, the impact of Covid 19 on resources and to determine the potential longer-term impact on traffic and air quality within the Chester AQMA. However, the AQAP has now been finalised and is being submitted to Defra in conjunction with this ASR.

Cheshire West and Chester has taken forward a number of direct measures during the current reporting years of 2020 and 2021 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2. Forty measures are included within Table 2, with the type of measure and the progress Cheshire West and Chester have made presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within the table.

More detail on these measures can be found in their respective Action Plans, the Low Emission Strategy and the Local Plan part 2. Key completed measures are:

- The installation of 12 DfT-funded (on-street residential chargepoint scheme, ORCS) double-socket fast electric vehicle chargepoints (EVCPs) across 6 Council car parks. (measure 5 of the Chester AQAP)
- The installation of 14 double-socket fast EVCPs in Canalside depot along with 2 rapid chargers at the nearby Boat Museum. Local Enterprise Partnership was match funded with Climate Emergency Funds for this project. (measure 6 of the Chester AQAP)
- Introduction of a box junction at the Fluin Lane / A56 (measure TI19 of the Frodsham AQAP)
- Completion of the rollout of the Borough-wide 20mph speed limit four-year programme (measure 39 in Table 2).
- Formalisation of planning conditions requiring EVCPs in new developments following adoption of the Local Plan, part 2 (measure 7, Chester AQAP).
- The revision of the council's vehicle procurement policy to require the purchase of ULEVs and the addition of a number of electric vehicles as part of the council's fleet.

Cheshire West and Chester expects the following prioritised measures to be completed over the course of the next reporting year:

- Revocation of the Whitby Road/Station Road AQMA in Ellesmere Port
- Review of the status of the Fluin Lane AQMA in Frodsham with consideration for potential revocation
- Completion and adoption of the EV strategy, which will help to inform and prioritise the rollout of additional EVCP infrastructure across a range of location types including on-street and Council workplaces.

- Rollout of a comprehensive local network of privately funded rapid EVCPs across the borough
- Installation of a mix of 40 fast and rapid EVCPs in the Northgate development's multistorey car park in Chester
- Completion of the taxi licensing consultation on the revision of Licensing policy that seeks to encourage and condition the adoption of EVs by operators
- Completion of a taxi driver engagement scheme to inform and demonstrate the feasibility and benefits of electric vehicles.
- Completion of the Parking Standards supplementary planning document

The principal challenges and barriers to implementation that Cheshire West and Chester anticipates facing are securing grant funding to support measures, ongoing staffing issues, effective engagement with partner organisations and balancing other council priorities.

Progress on the following measures has been slower than expected due to the impact of national covid-19 lockdowns and internal staffing issues:

- Completion and submission of the ASRs
- Finalisation and publication of the Chester city centre AQAP
- Installation and launch of the ORCS-funded EVCPs
- Installation and launch of the LEP-funded depot chargers
- Revocation of Ellesmere Port AQMA

Cheshire West and Chester anticipates that the measures stated above and in Table 2 will achieve compliance in the Ellesmere Port and Frodsham AQMAs.

Whilst the measures stated above and in Table 2 will help to contribute towards compliance, Cheshire West and Chester anticipates that the trial of the de-SOx sulphur-reducing catalytic dosing system at the refinery will need to continue for several years in order to prove its efficacy. Further additional measures not yet prescribed may be required in subsequent years to achieve compliance and enable the revocation of Chester city centre AQMA.

Table 2 - Progress on measures to improve air quality

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	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 Chester AQAP measure number 1	Freight delivery and service plans, work with local distribution centres to change delivery emissions	Freight and Delivery Management	Delivery and Service plans	2021	2025	CWCC Transport	Levelling Up Fund	NO	Not Funded	£1 million - £10 million	Planning	Reducing emissions contribution from HGVs, reduced queuing traffic in peak hours	Successful bid to the Levelling Up Fund. Detailed design completion.	Bid submitted to Levelling Up Fund for multimodal hub including last mile delivery facility.	If funding approved, further design work will follow and will form part of City Place development plan.
2 Chester AQAP measure number 2	HGV/LGV recognition schemes for Council contracts	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2021	2025	CWCC Transport		NO	Not Funded	£10k - 50k	Planning	NO_2 Emission Reduction	Amended procurement procedure	Not commenced	To ensure Council contracts require use of FORS or similar in Chester AQMA
3 Chester AQAP measure number 3	Collaborating with bus operators to introduce ultra-low emission vehicles into the bus fleet (new or retrofit). Target use of ULEV into the problem areas	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	2017	2023	CWCC Transport	N/A	NO	Not Funded	£500k - £1 million	Implementation	Reduced vehicle emissions	Number of ultra-low emission bus fleets introduced	On-going	Falling bus patronage and Covid disruption has impacted on operator priorities.
4 Chester AQAP measure number 4	Update taxi / private hiring policy	Promoting Low Emission Transport	Taxi Licensing conditions	2021	2022	CWCC Licensing	CWCC	NO	Funded	£10k - 50k	Planning	NO_2 Emission Reduction	Amendment of Taxi Licensing Policy	Public consultation on amended policy to require fleet transition to ULEV by 2036 commenced September 2021	This measure requires successful implementation of charging infrastructure, either by commercial third parties or the Council (Measure 5 below).
5 Chester AQAP measure number 5	Alternative fuel (EV) infrastructure development in city centre	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2018	2030	CWCC	CWCC/LEP/DfT/3rd-party	NO	Funded	£500k - £1 million	Implementation	NO_2 Emission Reduction	Number of alternative fuel (EV) infrastructure development in the city centre	Fast chargers delivered at Brook St & Bishop St car parks, EV hub comprising rapids and fast to come online 2022 at Northgate MSCP, Taxi rapids to come online early 2022.	Borough-wide EV strategy being developed. Continued rollout of EVCPs dependent on securing additional funding
6 Chester AQAP measure number 6	Procuring low emission vehicles for council-owned fleets	Promoting Low Emission Transport	Public Vehicle Procurement - Prioritising uptake of low emission vehicles	2019	2030	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO_2 Emission Reduction	Number of council-owned low emission fleet vehicles	Procurement policy amended to require ULEV first approach. EV chargers installed at depots	Dependent on fleet renewal dates, replacement has commenced and will run until 2030.

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	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
7 Chester AQAP measure number 7	Work together with developers to promote the inclusion of electric charging points for electric/hybrid vehicles at new development sites	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	2018	2030	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO_2 Emission Reduction	Number of properties and premises where charging points have been secured	Year 2019/2020 88 chargers installed. 2299 properties with cabling infrastructure.	2019/20: 47 residential and 12 commercial schemes required to install EVCPs/cabling. Figures for 2020/21 will be published October 2021. Parking standards SPD being updated 2021. Borough-wide measure
8 Chester AQAP measure number 8	Public transport infrastructure improvements, e.g. - Enhanced bus shelters - Accurate electronic timetables - m-tickets / contactless payment options	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2018	2025	CWCC / Public transport bodies	CWCC	NO	Not Funded	£100k - £500k	Implementation	NO_2 Emission Reduction	% modal shift to car share/public transport	Work not commenced	This area of work has not yet been scheduled.
9 Chester AQAP measure number 9	Incentivise public transport usage, e.g. - Provision of information about existing services - Campaigns - Season ticket loan/discounts - Subsidised tickets	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2021	2025	CWCC	tbc	NO	Not Funded	£50k - £100k	Implementation	NO_2 Emission Reduction	% modal shift to car share/public transport	Work not commenced	This area of work has not yet been scheduled.
10 Chester AQAP measure number 10	Behaviour change campaigns to reduce single occupancy car trips	Promoting Travel Alternatives	Intensive active travel campaign & infrastructure	2018	2023	CWCC	CWCC	NO	Funded	£10k - 50k	Planning	NO_2 Emission Reduction	% modal shift to car share/public transport	Funding has been identified and ring fenced.	Following identification of funding, a review of work area in conjunction with related measures e.g. Measure 12, is required.
11 Chester AQAP measure number 11	Flexible working and home working encouraged	Promoting Travel Alternatives	Encourage / Facilitate homeworking	2019	2022	CWCC	CWCC	NO	Funded	< £10k	Planning	NO_2 Emission Reduction	Number of people working from home	Modern workforce programme scheduled for full implementation February 2022	The Council has led by example and introduced home working. The next phase is to determine how best we can promote it. Covid 19 has furthered this.

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	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
12 Chester AQAP measure number 12	Promoting Car Club / Car Sharing Schemes/ Car Pooling	Promoting Travel Alternatives	Workplace Travel Planning	2021	2025	CWCC	CWCC	NO	Not Funded	< £10k	Planning	NO_2 Emission Reduction	% modal shift to car share/public transport	Not commenced	This work area needs substantial further development.
13 Chester AQAP measure number 13	Park and Ride Schemes with Euro VI Vehicles	Alternatives to private vehicle use	Bus based Park & Ride	2017	2023	CWCC / Bus operator	CWCC / Bus operator	NO	Funded	£1 million - £10 million	Implementation	NO_2 Emission Reduction	% modal shift to car share/public transport	Implemented	The focus is now on facilitating the transition to zero emission buses.
14 Chester AQAP measure number 14	On and off-street parking charges linked to vehicle emission standards - including any residents permits.	Traffic Management	Workplace Parking Levy, Parking Enforcement on highway	2021	2030	CWCC	bid application required	NO	Not Funded	£100k - £500k	Planning	NO_2 Emission Reduction	Improve traffic management	2021 funding application to appoint consultants unsuccessful.	This is a substantial work area and there is a need to identify funding to advance it both in terms of development, infrastructure / implementation.
15 Chester AQAP measure number 15	Restrict long stay parking in AQMA.	Traffic Management	Other	2021	2025	CWCC	CWCC	NO	Not Funded	£10k - 50k	Planning	NO_2 Emission Reduction	Improve traffic management	Not commenced	Substantial work area requiring funding and resourcing.
16 Chester AQAP measure number 16	Improve signage at main junctions within the AQMA and major spurs.	Transport Planning and Infrastructure	Other	2021	2025	CWCC	CWCC	NO	Not Funded	£50k - £100k	Planning	NO_2 Emission Reduction	Improve traffic management	Not commenced	Focus on smart digital signage to assist driver choice.
17 Chester AQAP measure number 17	Review active travel policy/strategy to identify opportunities to support delivery, for example improved Signage and cycle route/parking	Transport Planning and Infrastructure	Cycle network	2020	2023	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO_2 Emission Reduction	Improve traffic management	LCWIP published July 2020 Section 106 requirements successfully implemented through planning approval	Review of contribution AQAP can make needs to be undertaken as a priority. This will inform further work under this measure.
18 Chester AQAP measure number 18	Work together with developers to improve sustainable transport links serving new developments	Transport Planning and Infrastructure	Other	2019	2021	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO_2 Emission Reduction	Number of the developments providing sustainable transport links serving new developments	Local Plan Part 2 adopted 18 July 2019 strengthening planning obligations.	Government policy improvements expected 2021 to strengthen sustainability criteria. Borough-wide impact

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	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
19 Chester AQAP measure number 19	Provision of high quality, bespoke and accessible information on sustainable travel, e.g. on a dedicated travel website with route/mode options	Public Information	Via the Internet	2017	2022	CWCC	CWCC	NO	Funded	£10k - 50k	Implementation	NO_2 Emission Reduction	Number of hits on upgraded website per annum	Council have produced an app called iTravelsmart	Explore options to improve app and utilise it fully for the purpose of raising awareness and supporting other sustainable transport measures.
20 Chester AQAP measure number 20	Local air quality monitoring within the unitary authority to ensure a high standard of data is achieved	Public Information	Other	2021	2023	CWCC	CWCC	NO	Funded	£10k - 50k	Planning	NO_2 Emission Reduction	Number of monitoring locations	Funding has been ring fenced to introduced portable real-time monitors	Assessment and selection of appropriate monitoring devices needs to be undertaken.
21 Chester AQAP measure number 21	Low Emissions Strategy	Policy Guidance and Development Control	Low Emissions Strategy	2018	2021	CWCC	CWCC	YES	Funded	£10k - 50k	Completed	NO_2 Emission Reduction	The implementation of Low Emissions Strategy	Published September 2018	Targeting and prioritising implementation of measures on the AQMA. LES applies borough-wide
22 Chester AQAP measure number 22	Anti-idling enforcement at all on-street locations	Traffic Management	Other	2018	2020	CWCC	CWCC	NO	Funded	£10k - 50k	Completed	NO_2 Emission Reduction	Idling reduction	Legislation adopted, regular patrols in place.	Periodic review of intelligence to enable targeted patrols. Implemented borough-wide
23 Chester AQAP measure number 23	Review access permissions and use of the Northgate Street traffic barrier.	Traffic Management	Other	2021	2022	CWCC	CWCC	NO	Not Funded	< £10k	Planning	NO_2 Emission Reduction	Reduction in vehicles accessing the city centre during restricted day time hours.	Work not commenced	Presently access for taxis, hotel guests and disabled vehicles appears to be permitted although it is not clear whether this is supported by a traffic order.
24 Chester AQAP measure number 24	Explore the potential for extension of 20mph zones throughout the Chester AQMA.	Traffic Management	Reduction of speed limits, 20mph zones	2018	2022	CWCC	CWCC	NO	Not Funded	£10k - 50k	Planning	NO_2 Emission Reduction	Implementation of 20mph zones.	Work not commenced	A detailed scheme for reducing speed limits across the borough has been rolled out very successfully, the potential for extending this to the city centre needs to be assessed.

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	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
25 Frodsham AQAP measure number 1	Video survey of the Fluin Lane and Bears Paw junctions	Traffic Management	UTC, Congestion management, traffic reduction	2018	2019	CWCC	CWCC	NO	Funded	< £10k	Completed	NO_2 Emission Reduction	Measured annual mean NO2 concentrations in AQMA	Video camera survey carried out at Fluin / Red Lane junction	A video survey with turning counts on A56 replaces need for video surveys at Fluin and Bears Paw junctions
26 Frodsham AQAP measure number 8	Explore traffic regulation order (TRO) options for restricting HGVs travelling through the AQMA and Church Street	Traffic Management	UTC, Congestion management, traffic reduction	2018	2020	CWCC	CWCC	NO	Funded	< £10k	Implementation	NO_2 Emission Reduction	To be determined	Signage enhancement scheme commenced	TRO will not now be required, the preference being for a signage enhancement scheme warning drivers significantly in advance of height / weight restrictions to provide decision of selecting alternative routes
27 Frodsham AQAP measure number 10	Origin and destination survey to identify and liaise with commercial users of the route	Freight and Delivery Management	Route Management Plans/ Strategic routing strategy for HGV's	2018	2019	CWCC	CWCC	NO	Not Funded	< £10k	Completed	NO_2 Emission Reduction	Completion of survey	Video survey has been completed (see AQAP measure 1 above)	The video survey (AQAP measure 1) replaced the need for a full origin and destination survey
28 Frodsham AQAP measure number TI19	Box junction at the Main Street/Fluin Lane junction to remove queuing traffic at that point and reduce the impact of emissions	Traffic Management	UTC, Congestion management, traffic reduction	2017	2020	CWCC	CWCC	NO	Funded	< £10k	Completed	NO_2 Emission Reduction	Introduction of box junction	Box junction has been successfully implemented and is working well	Prevents vehicles from queuing across the Fluin Lane arm of the junction whilst the pedestrian crossing is in operation allowing some vehicles to exit Fluin Lane.
29 Thornton AQAP measure number 1	Remove sulphur compounds in process	Environmental Permits	Measures to reduce pollution through IPPC Permits going beyond BAT	2017	2025	Essar refinery	Operator	NO	Funded	Confidential	Implementation	Reduction in 15-min exceedances to less than 35 per year. Potential air quality benefit = medium (in the range of 25-40%)	SO_2 measured at CCU stack / SO_2 measured at local AQ monitoring stations	Trial in progress. New additive dosing kit installed June 2019	Trial of 'de-SOx' additive on the catalytic cracking unit in progress. New dosing kit should allow improved performance data. Complexity of setup means that the trial needs extended timeframe to prove efficacy

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	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
30 Thornton AQAP measure number 2	Schedule maintenance / repair on sulphur-critical plant to suit the weather	Environmental Permits	Other	2017	2030	Essar refinery	Operator	NO	Funded	Confidential	Implementation	SO_2 Emission Reduction (negligible)	SO2 measured at local AQ monitoring stations	Ongoing	Essar uses weather data to plan activities. Essar uses real time AQ monitoring data to respond rapidly to spikes.
31 Thornton AQAP measure number 3	Isolation of sulphur recovery units (SRU) to allow independent operation	Environmental Permits	Other	2017	2018	Essar refinery	Operator	NO	Funded	Confidential	Completed	SO_2 Emission Reduction (negligible)	Reduced sour gas flaring	Complete. Installed during 2018 turnaround	This allows one SRU to be shut down for maintenance while keeping the other online. Reduces sour gas flaring
32 Thornton AQAP measure number 4	Fuel gas scrubbing and fuel substitution	Environmental Permits	Other	2017	2018	Essar refinery	Operator	NO	Funded	Confidential	Completed	SO_2 Emission Reduction (negligible)	Sulphur content in refinery fuel gas	Complete. Installed during 2018 turnaround	Additional capability for removing sulphur from fuel gas (in addition to natural gas switch for some boilers)
33 Thornton AQAP measure number 5	Address fugitive emissions	Environmental Permits	Other	2017	2018	Essar refinery	Operator	NO	Funded	Confidential	Completed	SO_2 Emission Reduction (negligible)	SO2 measured at local AQ monitoring stations	Completed. Medium pressure (MP) superheater replaced in 2018 turnaround	Fugitive emissions are addressed as they are identified, e.g. MP superheater replaced as it was approaching end of life
34 Thornton AQAP measure number 6	Air quality monitoring	Public Information	Via the Internet	2017	2017	CWCC	CWCC	NO	Funded	< £10k	Implementation	Nil	Real-time data published on website	Ongoing	Results published on Council website, updated hourly. Currently posted daily due to system fault. Replacement commissioned 2019. Launch due late 2021
35 Thornton AQAP measure number 7	Real-time data provision to operator (with trigger capability)	Public Information	Via the Internet	2017	2021	CWCC / Essar	CWCC	NO	Funded	£10k - 50k	Implementation	Nil	Ongoing data sharing	Complete. Output data from both SO2 monitoring stations shared with Essar	Supports AQAP measure 2 above. Due to be superseded in tandem with AQAP measure 6 above
36 Borough-wide	Bikeability campaign (schools and adults only schemes)	Promoting Travel Alternatives	Promotion of cycling	2010	2025	CWCC Road safety	CWCC / Active Travel	NO	Funded	£50k - £100k	Implementation	Pollutant emission reduction	Increase in number cyclists	Ongoing. Subject to annual project review	DfT Active Travel / Council funded programmes ongoing

Measure No.	Measure	Category	Classification	Year Measure Introduced	Estimated / Actual Completion Year	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
37 Borough-wide	Let's Walk	Promoting Travel Alternatives	Promotion of walking	2015	2025	CWCC Road safety	CWCC	NO	Funded	< £10k	Implementation	Pollutant emission reduction	Improve pedestrian confidence to encourage more sustainable trips	Ongoing. Subject to annual project review	Child training promotes independence
38 Borough-wide	Schools crossing patrols	Promoting Travel Alternatives	Promotion of walking	2010	2030	CWCC Road safety	CWCC	NO	Funded	£100k - £500k	Implementation	Pollutant emission reduction	Improve pedestrian confidence to encourage more sustainable trips	Ongoing. Subject to annual project review	Supporting vulnerable road users cross the highway – when arriving and leaving educational establishments
39 Borough-wide	20mph limits on residential streets (740km)	Traffic Management	Reduction of speed limits, 20mph zones	2015	2021	CWCC	CWCC	NO	Funded	£500k - £1 million	Implementation	Reduced vehicle emissions borough wide	Successful rollout of scheme over four-year programme	Implemented	Promotes smoother driving style. Emissions reduction from vehicles should lead to overall emissions reduction. Fourth year of programme commenced summer 2019. Ongoing monitoring
40 Chester	Bus lane enforcement in Chester using automatic number plate recognition (ANPR)	Traffic Management	Strategic highway improvements, Re-prioritising road space away from cars, including Access management, Selective vehicle priority, bus priority, high vehicle occupancy lane	2019	2030	CWCC	CWCC	NO	Funded	£100k - £500k	Implementation	Reduced vehicle emissions	Bus patronage	Ongoing	To date over 1800 fines issued

$PM_{2.5}$ – Local Authority approach to reducing emissions and/or concentrations

As detailed in Policy Guidance LAQM.PG16 (Chapter 7), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases. Based on national estimates, the public health outcomes framework indicates that the fraction of mortality attributable to particulate matter in Cheshire West and Chester is 5.2% which is equivalent to some 161 premature deaths. This figure rises to 285 per year when the effects of NO_2 are taken into account. Reductions in air pollution can therefore deliver significant improvements in local health outcomes.

The Council does not monitor $PM_{2.5}$ as it is not currently a requirement of LAQM. However, PM_{10} (particulate matter with an aerodynamic diameter of 10µm or less) is recorded at three monitoring stations in the borough. Because $PM_{2.5}$ is a constituent of PM_{10}, it is possible to estimate the probable local levels by considering the ratio of the two fractions of particulate matter – as detailed in the technical guidance LAQM.TG16. Applying the nationally derived correction ratio of 0.7 to local data suggests that local $PM_{2.5}$ levels at local sites lie in the range 8.4 to 16.1µg/m^3 in 2020 and 9.8 to 14.7µg/m^3 in 2019, which is well below the national annual mean objective for background sites of 25µg/m^3 (to have been met by 2020). In recognition of the close association between particulates and health, these figures may be used as a benchmark against which to gauge local improvements over time. There is a national target value of 15% reduction at background urban locations between 2010 and 2020. Although this is not a requirement placed directly on local authorities, our long-term PM_{10} monitoring suggests that there was a reduction of 14% in $PM_{2.5}$ between 2010 and 2018 at monitoring station LR, Ellesmere Port and was therefore on course to achieve the target.

National policy guidance assumes that local authorities will consider how to address $PM_{2.5}$ alongside other pollutants and that few standalone $PM_{2.5}$ measures will need to be chosen unless they are needed to address a very specific local problem. So action to reduce PM_{10} and NO_2 would usually contribute to the reductions in $PM_{2.5}$. The Council is not, therefore,

expected to be required to carry out additional local review and assessment (including monitoring).

The Council is taking the following measures to address $PM_{2.5}$: measures listed in Table 2 above will contribute in general to improvements in levels of $PM_{2.5}$. The Council's Low Emission Strategy (LES) aims to tackle NO_2, PM_{10} and $PM_{2.5}$, with a focus on reducing emissions from road vehicles and supporting more sustainable modes of transport. The ultimate ambition is to improve the health of residents and reduce the number of deaths attributable to poor air quality that arise every year. The action toolbox, Table A.1 in LAQM.TG16 lists a range of measures that can be implemented to tackle $PM_{2.5}$ and many of these are incorporated into the LES. Examples include:

- Smoke control areas are in place in a number of the Borough's urban areas and the LES includes a measure focused on exploring the feasibility of expanding SCAs and publicising health concerns related to domestic burning. A local study of SCAs and health impacts of domestic smoke has been commenced.
- The Council has a policy to reduce speed limits from 30mph to 20mph on residential roads, particularly around schools, one of the benefits of which is to reduce emissions through the encouragement of smoother driving styles.
- A reduction in vehicle idling will deliver an immediate improvement in air quality particularly in urban centres. In January 2019, the Council approved the use of powers to require drivers of idling vehicles to switch off their engines while stationary. Enforcement officers are now authorised to issue fixed penalty notices to drivers who refuse to do so.
- A shift to electric vehicles is key in improving local air quality as there are no tailpipe emissions of $PM_{2.5}$ (as well as NO_2 and other gaseous pollutants). In May 2021 the first tranche of the Council's public chargepoints went live with 24 charging bays (part-funded through the On-street Residential Chargepoint Scheme (ORCS)). Concurrently, 14 double-socket chargers were installed at the Council's Canalside depot as well as two 50kW rapids and one 22kW fast charger at the Boat Museum in Ellesmere Port (part-funded through the Local Enterprise Partnership's Energy Fund).
- The hackney carriage / private hire vehicle age policy in the Council's licensing policy ensures vehicles entering the system must be under five years old and will not be licensed after they have reached 10 years old; or 15 years old in the case of wheelchair accessible vehicles. In the Chester AQMA, all hackney carriages must be

new at first registration. This rolling programme delivers a gradual improvement in vehicle emission standards over time. In order to further enhance this, the Licensing team commenced a consultation in 2021 on a licensing policy revision, which aims to require the staged transition of the local fleet to electric vehicles in advance of national phase-out of conventional vehicles.

The Environmental Protection team has a good working relationship with the Public Health team and will continue to work collaboratively to determine how air quality can be prioritised across a wide range of policy areas as well identifying specific measures to address $PM_{2.5}$.

3 Air quality monitoring data and comparison with air quality objectives and national compliance

This section sets out the monitoring undertaken within 2019 and 2020 by Cheshire West and Chester and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2016 and 2020 to allow monitoring trends to be identified and discussed.

Summary of monitoring undertaken

3.1.1 Automatic monitoring sites

Cheshire West and Chester undertook automatic (continuous) monitoring at six sites during 2019-2020. Table 3 in Appendix A shows the details of the automatic monitoring sites. The www.cheshirewestandchester.gov.uk/monitoringstations webpage presents automatic monitoring results for Cheshire West and Chester.

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

Cheshire West and Chester undertook non-automatic (i.e. passive) monitoring of NO_2 at 89 sites during 2019 and 86 sites during 2020. Table 4 in Appendix A presents the details of the non-automatic sites. On conclusion of 2018, diffusion tube monitoring was discontinued at 5 sites and 9 new sites were established from 2019. At the end of 2019, 13 tubes were discontinued but 10 new sites were set up.

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 33%), and distance correction. Further details on adjustments are provided in Appendix C.

3.1.3 Nitrogen dioxide (NO_2)

Table 5 to Table 7 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 2020 and 2019 datasets of monthly mean values are provided in Appendix B. Note that the concentration data presented in Table 16 and Table 17 includes distance corrected values, only where relevant.

In 2020 no exceedances of the annual mean objective were recorded at any monitoring sites. The highest results were 31.8µg/m^3 at C36 and 31.5µg/m^3 at T6, locations which pre-lockdown recorded the highest exceedance levels in the Borough. In contrast, exceedances of the annual mean objective were recorded at a number of relevant locations in 2019, all of which lie within existing AQMAs. Annual mean NO_2 in excess of 40µg/m^3 was recorded at 11 monitoring sites but following correction for distance to the facade of the nearest relevant receptor (i.e. dwelling), just four monitoring sites showed exceedances of the annual objective. All four of these, C11, C36, PG and T6 are within the Chester city centre AQMA. A further six were within 10% of the objective.

As no NO_2 exceedances were recorded outside of AQMAs, there is no need to declare or extend AQMAs. In both 2020 and 2019 no exceedances of the annual objective were recorded in either of the AQMAs in Ellesmere Port and Frodsham. Monitored levels of NO_2 in the Whitby Road / Station Road AQMA in Ellesmere Port have steadily declined over time and no exceedances have been recorded in the four years 2017-2020. We intend therefore to revoke the AQMA.

The highest annual means recorded by an automatic analyser were 29µg/m^3 in 2020 and 38µg/m^3 in 2019, both at CBI, which is adjacent to the bus interchange in Chester.

Annual average concentrations of NO_2 in 2020 were inevitably lower than in previous years due to reduced road traffic in lockdown – see Appendix F: Impact of COVID-19 upon LAQM for further information. Concentrations of NO_2 in 2019 were on the whole lower than those for 2018. After distance correction, six sites in 2018 exceeded whereas in 2019 just four sites were higher than the objective.

Thirteen NO_2 monitoring sites were on or close to school premises in 2019 (site codes BE, CPL, DEL, DSP, FMH (automatic station), GB, HHS, LVS, OSJ, RPS, UCA, UHS and WIM). This was reduced to 8 sites for 2020 (BE, BSP, CRH, HSS, CPL, FMH, LVS and RPS), although 3 three sites were newly established. The highest recorded annual mean at these locations *at the point of monitoring* was 40.5$\mu g/m^3$ at RPS in 2019. However, this monitoring site is not representative of relevant exposure and, following distance correction, the calculated annual mean at Rudheath Primary School itself was 27.9$\mu g/m^3$, which is well below the annual objective.

Annual mean NO_2 at the two residential receptors close to the M6 motorway (at which monitoring was established / re-established in 2016 to address concerns over the smart motorway upgrade) was 18.9$\mu g/m^3$ at AHH and 23.9$\mu g/m^3$ at AP in 2019. The roadworks are now complete and from January 2020 monitoring at AHH has now ceased. The annual mean at AP in 2020 was 16.3$\mu g/m^3$.

In Rudheath / Lostock the long-term diffusion tube, KR was supplemented with monitoring at RPS and GR in response to local concerns about the anticipated increase in HGV movements along the A530 associated with industrial development in Lostock. Results for RPS are discussed above. On the A530 in 2019, the higher NO_2 results were recorded at KR: 32.2$\mu g/m^3$ at the monitoring site, dropping to 26.9$\mu g/m^3$ at the nearest residential receptor with correction for distance from the road.

Five-year trends in the annual mean NO_2 are presented in the bar charts in Figure 1 to Figure 4. Most sites, particularly those at roadside locations show a noticable reduction in NO_2 levels over time, although caution should be used when drawing conclusions about 2020 data because of the impacts of lockdown. Levels of NO_2 in the Ellesmere Port AQMA have been consistently below the national objective for four years and show a steady downward trend. We intend, therefore, to revoke this AQMA.

Table 8 and Table 9 in Appendix A compare the ratified continuous monitored NO_2 hourly mean concentrations for the past five years with the air quality objective of 200$\mu g/m^3$, not to be exceeded more than 18 times per year. No exceedances of the hourly mean have

been recorded in either 2019 or 2020, in common with previous years. Annual mean results from diffusion tubes that are above 60μg/m^3 may indicate a likely exceedance of the hourly objective (as per LAQM.TG16 technical guidance). But in 2019 and 2020 no diffusion tube results were above 60μg/m^3 (the highest being 43.9μg/m^3, in 2019) so on the basis of monitoring, it is highly unlikely that the hourly objective is exceeded anywhere in the borough. A 2019 modelling study conducted by consultants Bureau Veritas, in preparation for the Chester AQAP, predicted potential exceedances over a small discrete area adjacent to the inner ring road. This is being investigated through the deployment of additional diffusion tubes; CBR, ON and SAB, which are close to the bus interchange in Chester. To date, the highest annual mean recorded at any of these sites was 28.5μg/m^3 and as such the hourly objective is not at risk of exceedance.

Comparisons of hourly means in the local network against nearby national automatic urban and rural network (AURN) sites are shown in sites is shown in Figure 9 and Figure 10.

A comparison of monthly average NO_2 at various sites between 2016 and 2020 is presented in Figure 11. This clearly shown the seasonality in monitoring data – levels in summer months tend to be lower than winter months when cold, calm conditions tend to lessen the dispersion of pollutants emitted near ground level (i.e. vehicles exhausts).

3.1.4 Particulate matter (PM_{10})

Table 10 and Table 11 in Appendix A: Monitoring results compares the independently ratified and adjusted monitored PM_{10} annual mean concentrations for the past five years with the air quality objective of 40μg/m^3. In both 2020 and 2019, PM_{10} levels were below the annual mean objective at all sites, and it has not been necessary to declare any AQMAs in respect of PM_{10}. In common with previous years, the highest monitored concentration of PM_{10} was recorded at the roadside site, CBI, which is located close to the bus interchange and the inner ring road in Chester. The annual mean here was 23μg/m^3, which despite being significantly higher than concentrations at background sites, remains below the 40μg/m^3 objective.

Table 12 and Table 13 in Appendix A compare the ratified continuous monitored PM_{10} daily (24-hour) 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. Instances of 24-hour readings above 50μg/m^3 were registered at all PM_{10} monitoring stations, although the maximum of nine recorded at CBI was comfortably below the threshold of the 35 permitted.

Long term trends in annual PM_{10} monitoring are shown in Figure 5. There is no clear trend in the data. Figure 6 shows the number of exceedances of the 24-hour mean objective over the last five years.

Daily PM_{10} readings from the local monitoring stations and other regional AURN sites are plotted in Figure 12 and Figure 13. It can be seen that the data follow similar patterns at certains times of the year, particularly during episodes of elevated concentrations. Bonfire night celebrations tend to result in PM episodes, as illustrated in Figure 16.

3.1.5 Particulate matter ($PM_{2.5}$)

The Council does not currently monitor $PM_{2.5}$ as it is not currently a requirement of LAQM. However, as $PM_{2.5}$ is a constituent fraction of PM_{10}, it is possible to estimate the probable local levels by considering the ratio of the two fractions of particulate matter, as detailed in the technical guidance LAQM.TG16. Applying the nationally derived correction ratio of 0.7 to local PM_{10} data suggests that local $PM_{2.5}$ levels at monitoring sites lay in the range 8.4 to 16.1$\mu g/m^3$ in 2020 and 9.8 to 14.7$\mu g/m^3$ in 2019, which is below the national annual mean objective of 25$\mu g/m^3$. It should be noted, however, that the highest recording site, CBI, is not a background site.

3.1.6 Sulphur dioxide (SO_2)

Table 14 and 15 in Appendix A compare the ratified continuous monitored SO_2 concentrations for 2020 and 2019 with the air quality objectives for SO_2.

In 2020 there were 21 occasions, spread over 6 days when the 15-minute objective of 266$\mu g/m^3$ was exceeded in the village of Thornton-le-Moors (monitoring site TLP, within the AQMA), and in 2019 there were 10 exceedances also spread over 6 days. These were significantly lower than the 66 exceedances recorded in 2018. At monitoring station ELT (in Elton), which lies less than a kilometre outside the eastern edge of the AQMA, there were 8 15-min exceedances in 2020 and 22 in 2019. The objective allows for 35 exceedances of the 15-min mean in a calendar year so in each case the objective was not exceeded at either monitoring station. However, the AQMA will remain in place and unaltered for the foreseeable future. A graphical representation of the numbers of 15-min exceedances over time is presented in Figure 8.

The hourly mean standard was exceeded once in Elton and not at all in Thornton-le-Moors. As there is an annual exceedance allowance of 24 hourly periods, so the objective was not exceeded.

The 24-hour objective was complied with at all monitoring stations during 2019 and 2020.

Figure 7 shows long term trends in 15-minute SO_2 99.9th percentiles (the concentration below which 99.9% of readings occur). The graph also shows data for former monitoring stations in Ellesmere Port, Helsby, Thornton-le-Moors and Frodsham (SG, HE, LR-JG, TLM and FMH), the details for which can be found in earlier LAQM reports. For most sites the monitoring period has not been long enough to determine an overall trend. In contrast to earlier years, the 99.9th percentiles for ELT and TLP are not significantly different from each other.

SO_2 15-minute results from the local monitoring stations and the AURN site at Speke, Liverpool are plotted in Figure 14 and Figure 15 (AQDM). Unlike the comparisons for NO_2 and PM_{10} (Figure 9 to Figure 13), the individual SO_2 plots do not exhibit similarities in their trends. This is because the main sources of high short-term SO_2 episodes are tall industrial stacks and wind direction and turbulence determine where and when the emission plumes reach ground level.

Appendix A: Monitoring results

Table 3 – 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)
BO	Boughton	Roadside	341864	366444	NO2	Yes, Chester	Chemiluminescent	25	3	1
CBI	Chester Bus Interchange	Roadside	340645	366802	NO2 PM10	Yes, Chester	Chemiluminescent BAM	5.1	6.6	1.6
ELT	Elton	Industrial	345642	375522	SO2	No	UV-fluorescent	0	N/A	2
FMH	Frodsham	Urban background	352445	378031	NO2 PM10	No	Chemiluminescent TEOM	24	7	2.5
TLP	Thornton-le-Moors, Park Road	Industrial	344103	374330	NO2 SO2 PM10	Yes, Thornton-le-Moors	Chemiluminescent UV-fluorescent BAM	38	N/A	2.5
WH	Whitby Road	Roadside	340197	376363	NO2	Yes, Ellesmere Port	Chemiluminescent	15	2.5	3.5

Notes:

(1) 0m if the monitoring site is at a location of exposure (e.g. installed on the façade of a residential property). Note, in all cases for Cheshire West and Chester sites, the distances given are lateral measurements to relevant exposure and do not represent the distance of the nearest relevant receptor from pollutant source

(2) N/A if not applicable

Table 4 – 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)
AP	Middlewich Road AP	Roadside	373386	371500	NO_2	No	0.0	34.0	No	1.8
BBC	Bluebell Close	Suburban	342622	364613	NO_2	No	16.0	15.0	No	1.5
BE	Bedward Row BE	Roadside	340239	366418	NO_2	Yes, Chester	0.5	2.4	No	2.4
BJ	Boughton BJ	Roadside	341401	366512	NO_2	Yes, Chester	0.1	2.5	No	2.4
BSP	Brookside Primary	Roadside	338380	375840	NO_2	No	12.0	0.5	No	2.0
C11	Christleton Road C11	Roadside	341915	366427	NO_2	Yes, Chester	0.0	1.0	No	2.0
C36	Christleton Road C36	Roadside	342000	366374	NO_2	Yes, Chester	0.5	1.4	No	2.5
C75	Christleton Road C75	Roadside	342056	366354	NO_2	Yes, Chester	0.5	2.0	No	2.5
CAN	Canal Street CAN	Roadside	340375	366730	NO_2	Yes, Chester	1.0	1.5	No	3.0
CBI1, CBI2, CBI3.	Bus Interchange CBI	Other	340647	366803	NO_2	Yes, Chester	0.0	6.6	Yes	1.6
CBR	Bus ramp CBR	Other	340676	366782	NO_2	Yes, Chester	0.0	n/a	No	2.5
CFL	Church St CFL	Roadside	351762	377862	NO_2	No	4.8	1.0	No	2.2

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)
CM	Whitchurch Road CM	Roadside	343761	365528	NO_2	No	0.0	5.0	No	2.2
CN	Chester Way CN	Roadside	366070	373905	NO_2	No	3.8	1.6	No	3.0
CP3	Canal Place CP3	Roadside	343970	365295	NO_2	No	4.0	2.3	No	2.4
CPL	Plough Lane CPL	Roadside	344377	365375	NO_2	No	1.1	0.7	No	2.1
CRH	Rookery Cottages CRH	Roadside	364171	372697	NO_2	No	0.0	3.5	No	1.5
CVR	Caldy Valley CVR	Roadside	342930	365901	NO_2	No	3.5	3.0	No	2.1
DA	Davenham DA	Roadside	365953	371113	NO_2	No	0.1	1.6	No	2.0
EB	Boughton EB	Roadside	341658	366487	NO_2	Yes, Chester	0.0	2.0	No	2.5
FH	High Street FH	Roadside	352146	378139	NO_2	Yes, Frodsham	0.2	2.0	No	2.5
FJ	Fluin Lane FJ	Roadside	352171	378140	NO_2	Yes, Frodsham	0.5	2.0	No	2.5
FM	Fluin Lane FM	Roadside	352189	378094	NO_2	Yes, Frodsham	0.3	2.0	No	2.5
FRC	High Street FRC	Roadside	352023	378121	NO_2	No	1.3	1.6	No	2.5
FT	Fluin Lane FT	Roadside	352176	378105	NO_2	Yes, Frodsham	0.2	1.7	No	2.0

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)
FTG	High Street FTG	Roadside	351993	378102	NO_2	No	4.5	0.8	No	2.5
GE	George Street GE	Roadside	340657	366730	NO_2	Yes, Chester	1.0	5.0	No	2.4
GR	Griffiths Road GR	Roadside	368634	374714	NO_2	No	0.2	8.0	No	1.8
GSW	Gorse Stacks GSW	Roadside	340700	366687	NO_2	Yes, Chester	1.0	1.6	No	2.1
GT	George Street GT	Roadside	340611	366747	NO_2	Yes, Chester	0.0	1.9	No	2.6
HB	Hoole Lane HB	Roadside	341605	366527	NO_2	Yes, Chester	3.0	1.2	No	2.4
HHB	Holme Street HHB	Roadside	347953	366723	NO_2	No	5.3	2.9	No	2.5
HO	Hoole Road HO	Roadside	341311	367207	NO_2	No	0.0	7.1	No	1.9
HSS	High Street Sch. HSS	Roadside	364711	366339	NO_2	No	8.0	4.0	No	2.4
HTC	Holme Street HTC	Roadside	348333	366763	NO_2	No	3.1	2.0	No	2.0
HW	Hoole Way HW	Roadside	340881	366826	NO_2	Yes, Chester	1.0	1.9	No	2.4
IC	Christleton Road IC	Roadside	342068	366332	NO_2	Yes, Chester	2.0	2.0	No	2.0
KR	King Street KR	Roadside	368432	372988	NO_2	No	4.5	2.2	No	2.0

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)
LH	Lincoln House LH	Roadside	341126	366540	NO_2	Yes, Chester	3.0	2.0	No	3.0
LI2	Liverpool Road LI2	Roadside	340354	367034	NO_2	Yes, Chester	7.0	2.5	No	2.2
LU	Lumley Place LU	Roadside	340838	366215	NO_2	Yes, Chester	0.0	9.4	No	2.1
LVR	Love Street LVR	Roadside	340980	366315	NO_2	Yes, Chester	0.0	1.8	No	2.2
LVS	Love Street LVS	Roadside	340990	366317	NO_2	Yes, Chester	8.0	1.8	No	2.2
MCC	Whitchurch Road MCC	Roadside	343785	365502	NO_2	No	0.5	2.4	No	2.0
MUL	Mulberry Close MUL	Roadside	346258	375321	NO_2	No	0.0	27.0	No	2.0
NCS	New Crane Street NCS	Roadside	339857	366460	NO_2	No	0.0	1.8	No	2.0
NIN	Nicholas Street NIN	Roadside	340284	366199	NO_2	Yes, Chester	0.0	3.0	No	2.3
NIS	Nicholas Street NIS	Roadside	340329	366114	NO_2	Yes, Chester	0.0	4.3	No	2.2
NSR	Station Road NSR	Roadside	366796	373984	NO_2	No	0.6	1.7	No	2.2
NWH	Winnington Hill NWH	Roadside	365590	373904	NO_2	No	2.4	0.7	No	2.4
OB	Boughton OB	Roadside	341633	366510	NO_2	Yes, Chester	0.6	2.5	No	2.5

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)
OF	St Oswalds OF	Roadside	340453	366853	NO_2	Yes, Chester	0.0	4.8	No	3.0
ON	St Oswalds ON	Roadside	340718	366815	NO_2	Yes, Chester	4.4	15.5	No	2.5
OP	Oulton Place OP	Roadside	340636	366770	NO_2	Yes, Chester	0.0	1.6	No	2.1
OSQ	Over Square OSQ	Roadside	364053	365977	NO_2	No	5.5	2.2	No	2.4
OVH	Overleigh Road OVH	Roadside	340770	365605	NO_2	No	0.0	1.3	No	2.5
OW	St Oswalds OW	Roadside	340623	366823	NO_2	Yes, Chester	2.3	2.3	No	2.3
PA	Parkgate Road PA	Roadside	340313	367014	NO_2	Yes, Chester	2.4	0.8	No	2.4
PG	Parkgate Road PG	Roadside	340322	366989	NO_2	Yes, Chester	0.2	1.8	No	2.0
QRN	Quarry Road QRN	Roadside	330565	378063	NO_2	No	0.0	3.0	No	2.0
RM	Parkgate Road RM	Roadside	340291	367108	NO_2	Yes, Chester	0.0	3.8	No	2.2
RPS	Rudheath Primary RPS	Roadside	367856	372667	NO_2	No	19.0	5.2	No	2.2
RR	Whitby Road RR	Roadside	340180	376338	NO_2	Yes, Ellesmere Port	3.0	2.1	No	2.5
SA	Upper Northgate SA	Roadside	340364	366929	NO_2	Yes, Chester	0.2	2.5	No	2.5

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)
SAB	Stanley Arms SAB	Roadside	340838	366746	NO_2	Yes, Chester	4.9	2.3	No	2.5
SF	Station Road SF	Roadside	341238	366976	NO_2	No	0.0	3.2	No	2.2
SLW	Stanney Wellington	Roadside	339889	375755	NO_2	No	3.0	3.2	No	2.0
SMH	St Martins SMH	Roadside	340243	366511	NO_2	Yes, Chester	0.7	2.2	No	2.0
SR	Station Road SR	Roadside	340435	376790	NO_2	Yes, Ellesmere Port	0.0	1.6	No	2.5
ST	St. Annes Place ST	Roadside	340794	366778	NO_2	Yes, Chester	18.4	0.1	No	2.2
SV2	South View Road SV2	Roadside	339836	366620	NO_2	No	0.4	1.5	No	1.9
SZ	Boughton SZ	Roadside	341819	366475	NO_2	Yes, Chester	0.5	2.0	No	2.5
T11	Tarvin Road T11	Roadside	341931	366458	NO_2	Yes, Chester	2.7	1.5	No	2.1
T44	Tarvin Road T44	Roadside	342085	366446	NO_2	Yes, Chester	3.5	1.0	No	2.5
T6	Tarvin Road T6	Roadside	341926	366446	NO_2	Yes, Chester	0.2	2.0	No	2.0
TA	Tarvin Road TA	Roadside	344519	366898	NO_2	No	6.0	2.0	No	2.0
TB	Bars TB	Roadside	341202	366470	NO_2	Yes, Chester	2.0	1.0	No	2.5

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)
TBV	Tarvin Road TBV	Roadside	344013	366830	NO_2	No	14.4	1.4	No	2.5
UN	Upper Northgate Street UN	Roadside	340357	366960	NO_2	Yes, Chester	0.2	3.0	No	2.2
VXR	Vicars Cross Road VXR	Roadside	343365	366694	NO_2	No	1.7	11.2	No	1.8
WCR	Whitchurch Road WCR	Roadside	342951	366029	NO_2	No	7.2	1.5	No	2.0
WG	Watergate Street WG	Roadside	340217	366209	NO_2	Yes, Chester	0.2	1.5	No	2.0
WGW	Watergate Street WGW	Roadside	340165	366198	NO_2	Yes, Chester	0.0	2.2	No	2.2
WH1, WH2, WH3.	Whitby Road WH	Roadside	340196	376363	NO_2	Yes, Ellesmere Port	0.5	1.2	Yes	3.5
WVC	Weaver Court	Roadside	365788	373744	NO_2	No	0.0	4.0	No	2.0
XR	Boughton Heath XR	Roadside	343117	365949	NO_2	No	4.5	3.2	No	2.0

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 5 – Annual mean NO_2 monitoring results (2020): 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 2020 (%) (2)	2016	2017	2018	2019	2020
BO	341864	366444	Roadside	99.2	99.2	29	27	25	23	17
CBI	340645	366802	Roadside	99.6	99.6		**40**	**40**	38	29
FMH	352445	378031	Urban Background	99.6	99.6	16	14	14	15	13
TLP	344103	374330	Industrial	99.1	99.1	16	13	13	13	9
WH	340197	376363	Roadside	99.4	99.4	**40**	36	37	35	28

Table 6 – Annual Mean NO_2 monitoring results (2019): automatic monitoring (µg/m^3)

Site ID	X OS Grid reference (Easting)	Y OS Grid reference (Northing)	Site type	Monitoring type	Valid data capture for monitoring period (%) (1)	Valid data capture 2019 (%) (2)	NO_2 Annual mean concentration (µg/m^3)				
							2015	2016	2017	2018	2019
BO	341864	366444	Roadside	Automatic	97.6	97.6	30	29	27	25	23
CBI	340645	366802	Roadside	Automatic	99.5	99.5			**40**	**40**	38
FMH	352445	378031	Urban background	Automatic	99.6	99.6	15	16	14	14	15
TLP	344103	374330	Industrial	Automatic	99.3	99.3	16	16	13	13	13
WH	340197	376363	Roadside	Automatic	95.8	95.8	**40**	**40**	36	37	35

☒ Annualisation has been conducted where data capture is <75% and >33% in line with LAQM.TG1.

☒ 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.TG16 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 7 – 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 2020 (%) (2)	2016	2017	2018	2019	2020
AHH	373255	371475	Roadside			21.5	17.7	19.4	18.9	
AP	373386	371500	Roadside	59.6	59.6	31.2	28.3	25.3	23.9	16.3
BBC	342622	364613	Suburban	59.6	59.6					14.0
BE	340239	366418	Roadside	76.9	76.9	40.2	37.5	33.8	32.1	22.2
BJ	341401	366512	Roadside	76.9	76.9	39.0	38.7	39.5	33.9	24.6
BO	341864	366444	Roadside			30.5	29.2	28.7	23.1	
BSP	338380	375840	Roadside	67.3	67.3					16.2
BZ	341161	366460	Roadside				27.3			
C11	341915	366427	Roadside	76.9	76.9	43.3	43.0	41.1	41.0	27.8
C36	342000	366374	Roadside	76.9	76.9	51.5	50.8	47.6	43.9	31.8
C75	342056	366354	Roadside	76.9	76.9	30.4	26.9	27.2	26.4	18.9
CAN	340375	366730	Roadside	76.9	76.9		25.1	32.6	31.2	19.4
CBI1-3	340647	366803	Other	76.9	76.9		44.6	38.9	36.4	26.4
CBR	340676	366782	Other	76.9	76.9					24.4
CFL	351762	377862	Roadside	76.9	76.9	31.3	30.4	30.5	29.9	21.6
CIN	341219	366768	Roadside			29.1	29.5			
CIS	341219	366692	Roadside			30.9	28.0			
CM	343761	365528	Roadside	76.9	76.9		30.8	33.9	32.6	23.1
CN	366070	373905	Roadside	76.9	76.9			33.0	31.0	24.1
CP3	343970	365295	Roadside	76.9	76.9		31.9	31.3	30.9	22.9
CPL	344377	365375	Roadside	76.9	76.9			19.0	18.2	11.8
CRH	364171	372697	Roadside	67.3	67.3					12.6
CVR	342930	365901	Roadside	76.9	76.9		30.3	30.2	27.8	19.9
DA	365953	371113	Roadside	76.9	76.9				19.1	14.9

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 2020 (%) [2]	2016	2017	2018	2019	2020
DEL	355255	368416	Roadside					20.2	19.0	
DSP	351627	364552	Roadside					25.3	21.8	
EB	341658	366487	Roadside	76.9	76.9	34.8	34.5	31.6	30.7	22.4
FGS	340859	366388	Roadside			31.7	27.2	28.9	27.6	
FH	352146	378139	Roadside	76.9	76.9	44.2	39.4	38.5	36.9	27.4
FJ	352171	378140	Roadside	76.9	76.9	42.2	40.5	38.2	36.9	28.6
FM	352189	378094	Roadside	61.5	61.5	36.5	33.2	35.0	29.4	24.3
FRC	352023	378121	Roadside	76.9	76.9			34.0	31.0	24.3
FT	352176	378105	Roadside	76.9	76.9	34.9	34.2	32.1	29.8	23.7
FTG	351993	378102	Roadside	76.9	76.9			33.2	30.6	22.4
GB	364619	372594	Roadside					17.3	16.0	
GD	340331	366998	Roadside			33.9				
GE	340657	366730	Roadside	67.3	67.3	24.8	26.9	32.0	30.7	20.1
GI	341951	366396	Roadside			34.8	33.4			
GR	368634	374714	Roadside	76.9	76.9			24.1	21.6	17.0
GSW	340700	366687	Roadside	59.6	59.6	27.8	33.3	34.3	33.9	23.2
GT	340611	366747	Roadside	76.9	76.9		26.1	34.1	30.5	23.0
HB	341605	366527	Roadside	76.9	76.9	33.7	32.9	32.0	30.9	21.6
HHB	347953	366723	Roadside	59.6	59.6				32.1	17.8
HHS	349518	375954	Roadside					22.7	21.4	
HO	341311	367207	Roadside	76.9	76.9			31.7	28.6	21.6
HSS	364711	366339	Roadside	61.5	61.5					19.2
HTC	348333	366763	Roadside	57.7	57.7				33.2	19.7
HW	340881	366826	Roadside	59.6	59.6	39.9	36.0	35.8	32.0	21.1
IC	342068	366332	Roadside	76.9	76.9	38.5	36.7	34.5	34.5	23.7

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 2020 (%) (2)	2016	2017	2018	2019	2020
KR	368432	372988	Roadside	76.9	76.9	35.2	33.9	32.0	32.2	26.0
LH	341126	366540	Roadside	76.9	76.9	38.4	39.2	36.9	29.7	22.8
LI2	340354	367034	Roadside	76.9	76.9	39.4	39.7	38.6	38.8	27.6
LU	340838	366215	Roadside	76.9	76.9		27.9	27.0	24.1	16.4
LVR	340980	366315	Roadside	44.2	44.2	40.8	35.9	36.5	34.9	19.7
LVS	340990	366317	Roadside	76.9	76.9	39.1	36.0	31.4	28.3	19.2
MCC	343785	365502	Roadside	67.3	67.3	44.5	40.8	38.0	36.9	22.9
MOS	341245	369610	Roadside					28.1	24.2	
MUL	346258	375321	Roadside	76.9	76.9				16.8	13.4
NCS	339857	366460	Roadside	76.9	76.9			30.5	27.8	20.4
NIN	340284	366199	Roadside	76.9	76.9	39.1	39.8	34.7	33.9	24.0
NIS	340329	366114	Roadside	76.9	76.9	22.6	28.6	31.7	29.0	21.2
NS	340406	376724	Roadside			36.2	35.0	32.4		
NSR	366796	373984	Roadside	76.9	76.9			38.0	35.3	27.6
NWH	365590	373904	Roadside	67.3	67.3			41.5	41.7	27.8
OB	341633	366510	Roadside	76.9	76.9	41.2	39.8	44.8	36.1	29.0
OF	340453	366853	Roadside	76.9	76.9	38.8	35.3	34.3	30.6	21.5
ON	340718	366815	Roadside	67.3	67.3				23.3	16.5
OP	340636	366770	Roadside	76.9	76.9		28.3	32.1	30.8	22.3
OSJ	363781	366198	Roadside					20.8	20.1	
OSQ	364053	365977	Roadside	61.5	61.5					23.2
OVH	340770	365605	Roadside	76.9	76.9					19.3
OW	340623	366823	Roadside	59.6	59.6	51.0	51.8	43.6	43.3	27.2
PA	340313	367014	Roadside	76.9	76.9	42.3	42.7	41.2	40.3	27.9
PG	340322	366989	Roadside	76.9	76.9	46.9	46.0	45.2	40.8	29.9

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 2020 (%) [2]	2016	2017	2018	2019	2020
QRN	330565	378063	Roadside	69.2	69.2					26.6
RM	340291	367108	Roadside	76.9	76.9	43.1	41.3	45.7	38.8	28.6
RPS	367856	372667	Roadside	76.9	76.9			42.4	40.5	29.0
RR	340180	376338	Roadside	76.9	76.9	39.9	36.8	36.5	35.2	30.0
SA	340364	366929	Roadside	76.9	76.9	39.8	36.9	37.7	34.4	24.8
SAB	340838	366746	Roadside	76.9	76.9				28.5	23.3
SF	341238	366976	Roadside	76.9	76.9		32.3	33.3	32.0	21.8
SLW	339889	375755	Roadside	53.8	53.8					16.8
SM	340224	366599	Roadside			32.1	27.7	25.2		
SMH	340243	366511	Roadside	51.9	51.9				26.0	15.7
SR	340435	376790	Roadside	76.9	76.9	36.5	34.3	33.8	31.0	26.3
ST	340794	366778	Roadside	76.9	76.9		44.6	42.4	40.2	30.1
SV2	339836	366620	Roadside	76.9	76.9			25.4	22.7	16.6
SV3	339859	366620	Roadside				24.8	26.0		
SZ	341819	366475	Roadside	76.9	76.9	36.3	36.4	36.1	32.1	22.9
T11	341931	366458	Roadside	76.9	76.9		32.0	31.8	28.6	19.6
T44	342085	366446	Roadside	76.9	76.9	42.8	40.2	39.2	37.6	25.7
T6	341926	366446	Roadside	76.9	76.9	50.3	45.5	43.6	43.6	31.5
TA	344519	366898	Roadside	76.9	76.9		47.4	44.5	38.6	26.7
TB	341202	366470	Roadside	69.2	69.2	38.7	36.0	36.7	33.3	25.0
TBV	344013	366830	Roadside	69.2	69.2				44.4	28.2
TE	340739	366504	Roadside				21.7	25.3		
UCA	339687	375972	Roadside					28.6	24.9	
UHS	342010	369154	Roadside					26.4	26.1	
UN	340357	366960	Roadside	76.9	76.9	40.1	36.8	38.1	33.5	21.4

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 2020 (%) (2)	2016	2017	2018	2019	2020
VRC	344129	365614	Roadside					18.2		
VXR	343365	366694	Roadside	59.6	59.6					19.0
W23	343729	365561	Roadside				29.2	33.1	30.6	
WCR	342951	366029	Roadside	69.2	69.2		41.1	39.0	41.1	25.8
WG	340217	366209	Roadside	76.9	76.9	43.5	42.8	39.8	35.2	27.3
WGW	340165	366198	Roadside	67.3	67.3	37.1	33.3	33.7	29.6	23.7
WH1-3	340196	376363	Roadside	76.9	76.9	34.4	32.3	35.7	31.4	25.8
WIM	368933	363614	Roadside					31.7	27.8	
WVC	365788	373744	Roadside	76.9	76.9					17.3
WXP	339641	363499	Roadside			20.1	17.4			
XR	343117	365949	Roadside	59.6	59.6			31.1	29.7	18.2

☒ Annualisation has been conducted where data capture is <75% and >33% in line with LAQM.TG16.

☒ 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**.

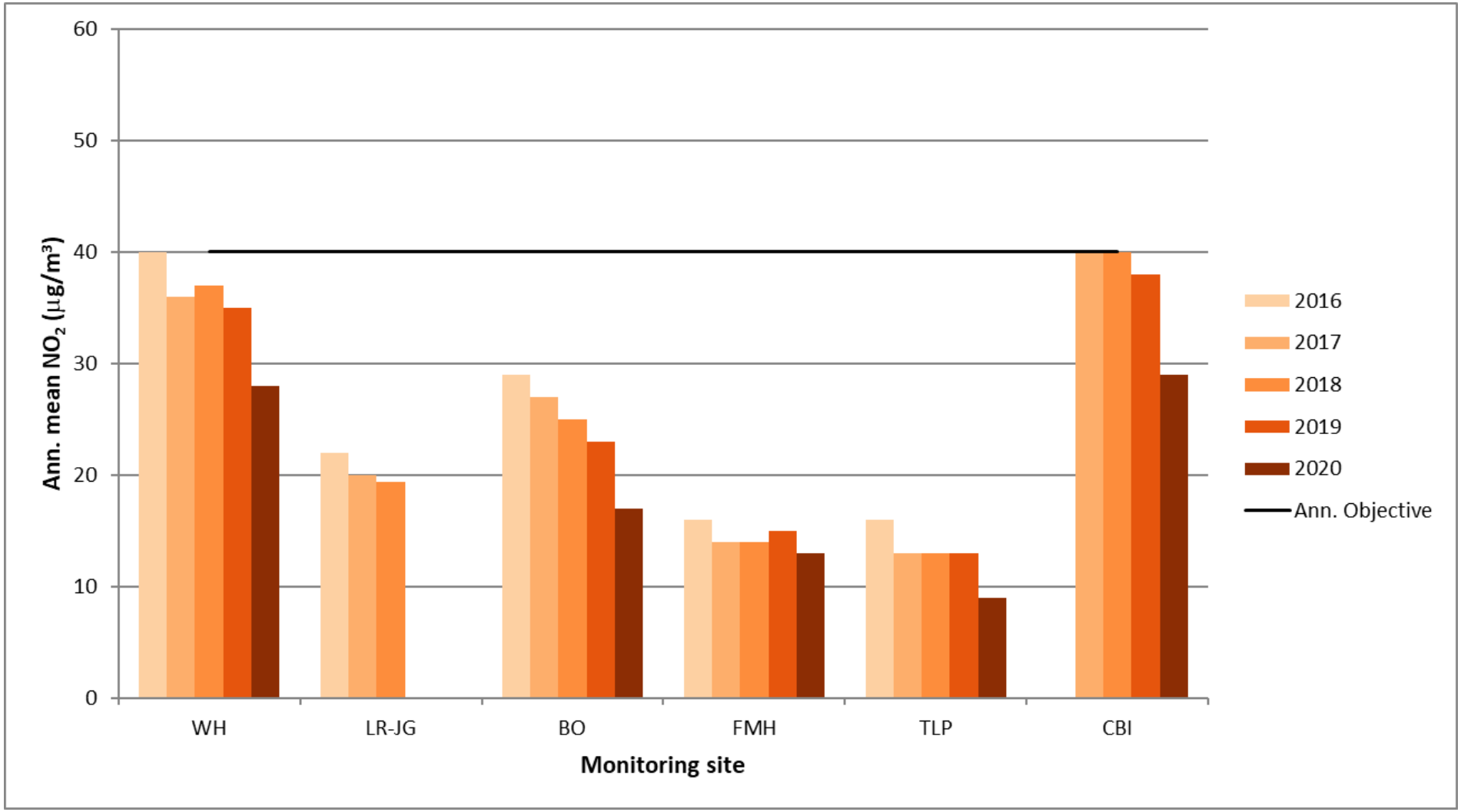
Means for diffusion tubes have been corrected for bias. All means have been "annualised" as per LAQM.TG16 if valid data capture for the full calendar year is less than 75%. See Appendix C for details.

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 1 – Trends in annual mean NO_2 concentrations – automatic sites



Note: Colour symbols used for bar charts sourced from: ColorBrewer.org

Figure 2 – Trends in annual mean NO_2 concentrations – Chester AQMA

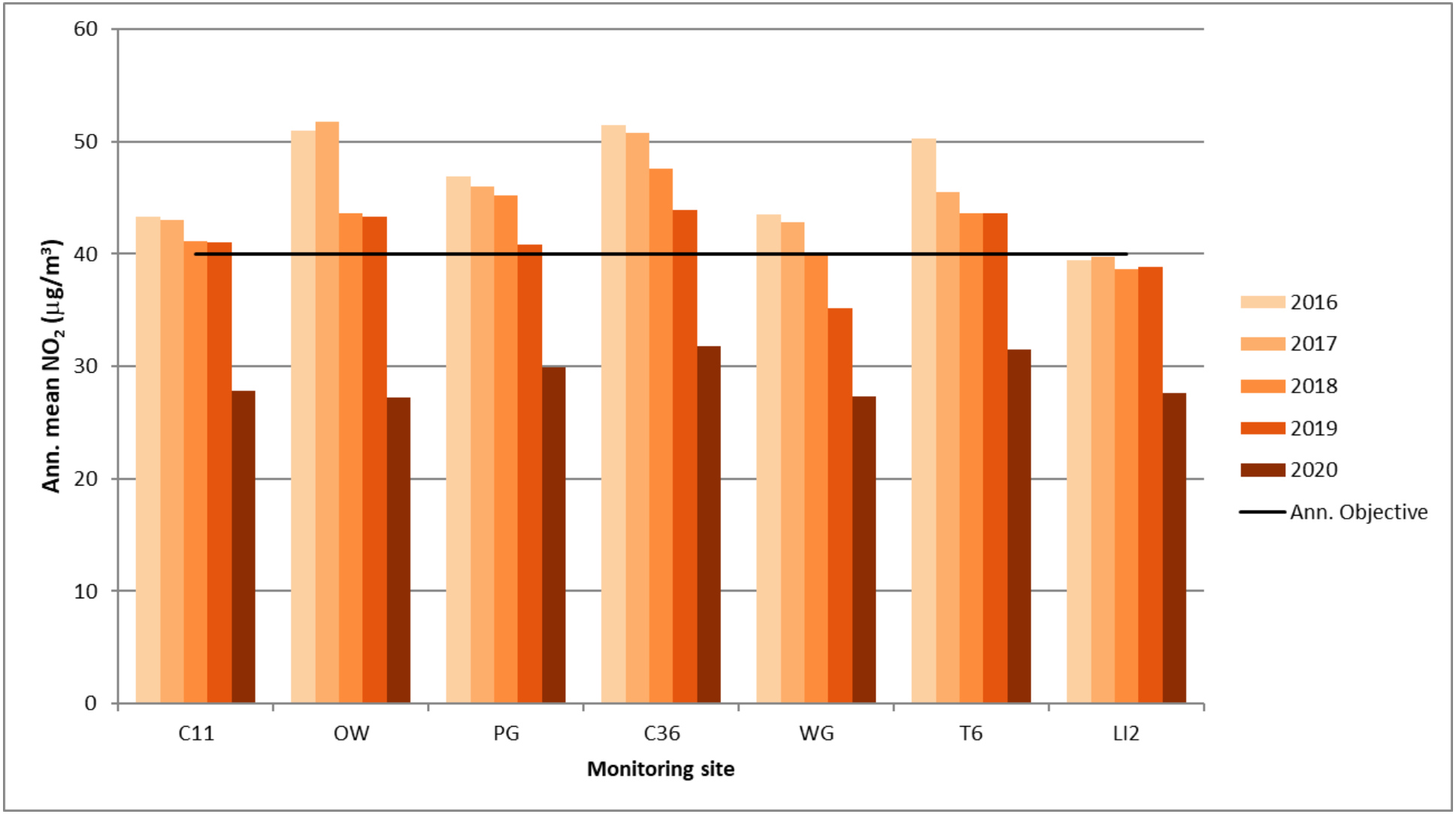


Figure 3 – Trends in annual mean NO_2 concentrations – Ellesmere Port AQMA

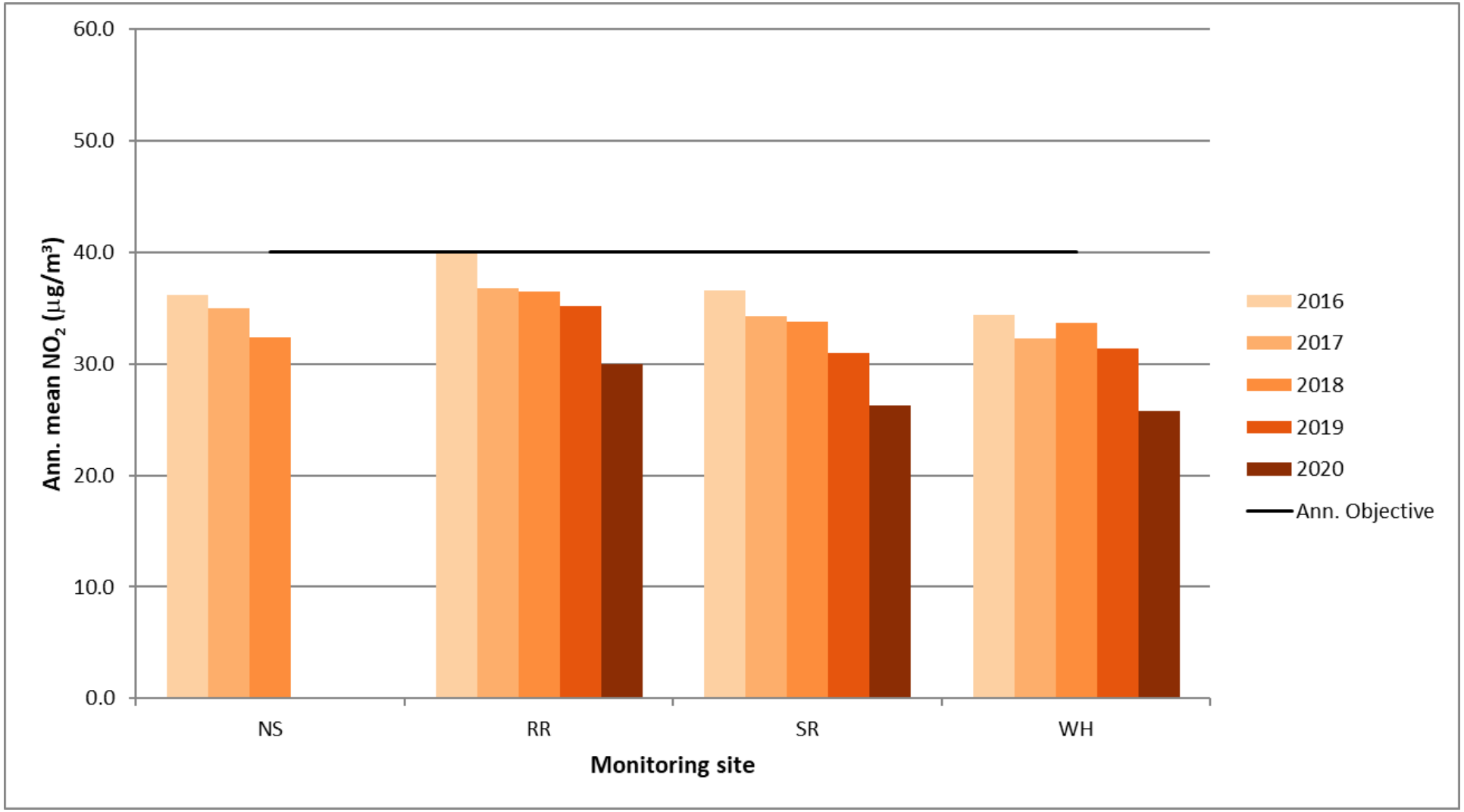


Figure 4 – Trends in annual mean NO_2 concentrations – Frodsham AQMA

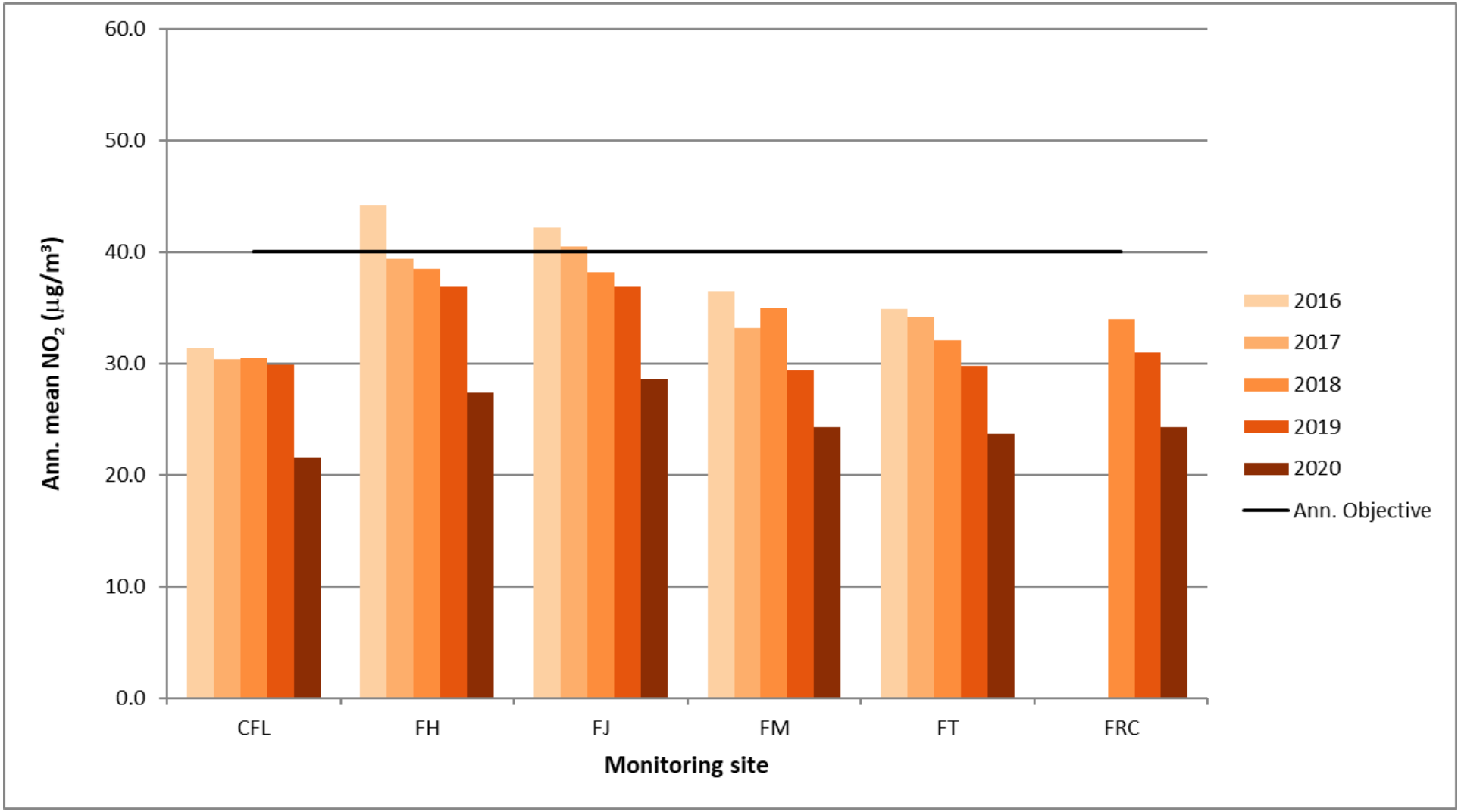


Table 8 – 1-Hour mean NO_2 monitoring results (2020), number of 1-hour means > 200µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2020 (%) (2)	2016	2017	2018	2019	2020
BO	341864	366444	Roadside	99.2	99.2	0	0	0	0	0
CBI	340645	366802	Roadside	99.6	99.6		0	0	0	0
FMH	352445	378031	Urban Background	99.6	99.6	0	0	0	0	0
TLP	344103	374330	Industrial	99.1	99.1	0	0	0	0	0
WH	340197	376363	Roadside	99.4	99.4	0	0	0	0	0

Table 9 – 1-Hour mean NO_2 monitoring results (2019), number of 1-hour means > 200µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site type	Monitoring type	Valid data capture for monitoring period (%) (1)	Valid data capture 2019 (%) (2)	NO_2 1-Hour means greater than 200µg/m^3 (3)				
							2015	2016	2017	2018	2019
BO	341864	366444	Roadside	Automatic	97.6	97.6	0	0	0	0	0
CBI	340645	366802	Roadside	Automatic	99.5	99.5			0	0	0
FMH	352445	378031	Urban background	Automatic	99.6	99.6	0	0	0	0	0
TLP	344103	374330	Industrial	Automatic	99.3	99.3	0	0	0	0	0
WH	340197	376363	Roadside	Automatic	95.8	95.8	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 10 – Annual mean PM_{10} monitoring results 2020 (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 2020 (%) (2)	2016	2017	2018	2019	2020
CBI	340645	366802	Roadside	97.7	97.7	**-**	21	21	21	23
FMH	352445	378031	Urban Background	96.7	96.7	14	13	16	15	12
LR	339947	375889	Urban Background	-	-	12	12	12	**-**	**-**
TLP	344103	374330	Industrial	98.3	98.3	16	13	13	14	13

Table 11 – Annual mean PM_{10} monitoring results 2019

Site ID	X OS Grid reference (Easting)	Y OS Grid reference (Northing)	Site type	Valid data capture for monitoring period (%) (1)	Valid data capture 2019 (%) (2)	PM_{10} Annual mean concentration (µg/m^3) (3)				
						2015	2016	2017	2018	2019
CBI	340645	366802	Roadside	99.1	99.1	-	-	21	21	21
FMH	352445	378031	Urban background	93.0	93.0	15	14	13	16	15
LR	339947	375889	Urban background	-	-	13	12	12	12	-
TLP	344103	374330	Industrial	98.3	98.3	15	16	13	13	14

☒ Annualisation has been conducted where data capture is <75% and >33% in line with LAQM.TG16.

Notes:

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

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

All means have been "annualised" as per LAQM.TG16 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 5 – Trends in annual mean PM_{10} concentrations

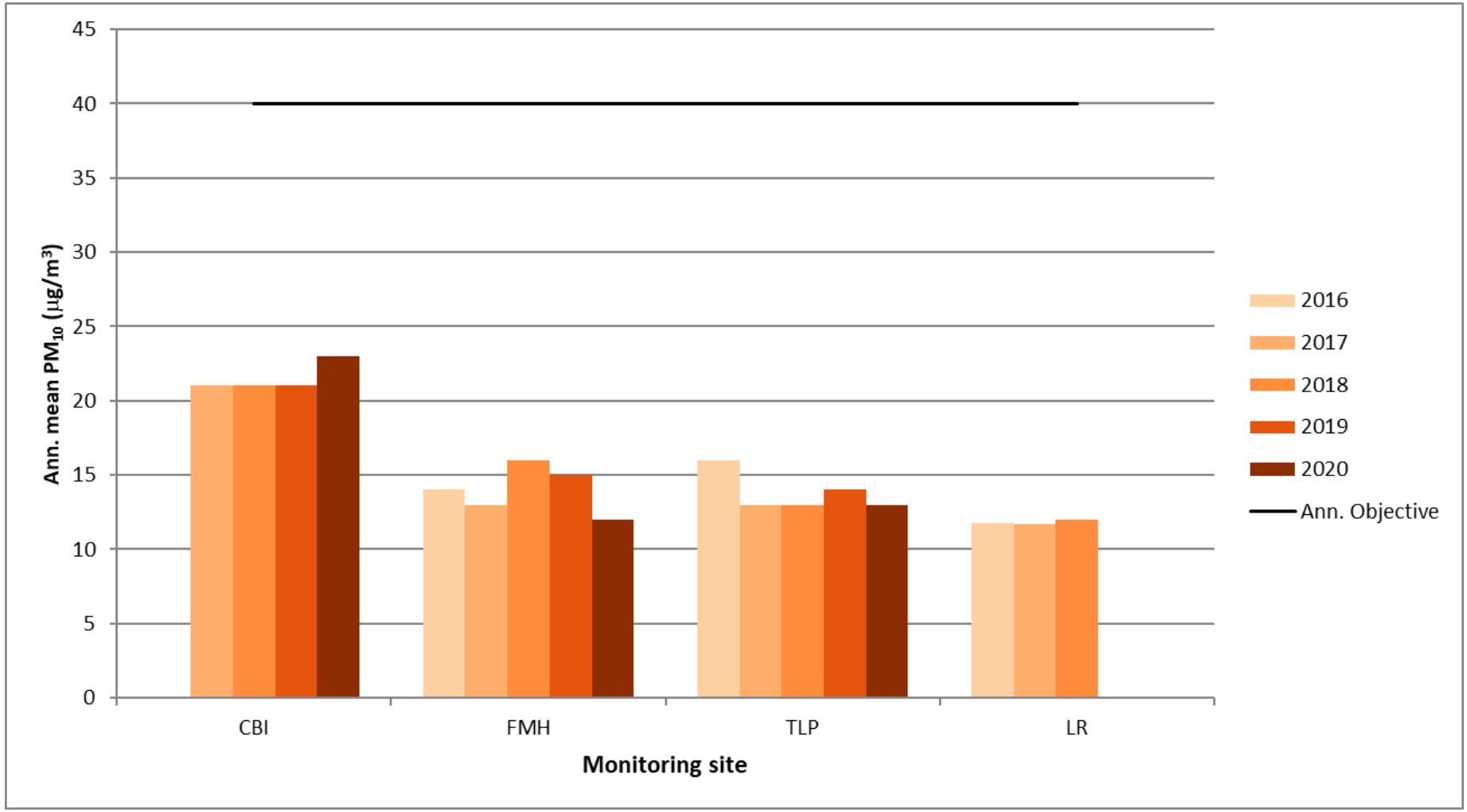


Table 12 – 24-Hour mean PM_{10} monitoring results (2020), number of PM_{10} 24-hour means greater than 50µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2020 (%) (2)	2016	2017	2018	2019	2020
CBI	340645	366802	Roadside	97.7	97.7	**-**	8	4	9	4
FMH	352445	378031	Urban Background	96.7	96.7	0	0	0	1	0
LR	339947	375889	Urban Background	-	-	0	0	0	**-**	**-**
TLP	344103	374330	Industrial	98.3	98.3	0	2	0	3	0

Table 13 – 24-Hour mean PM_{10} monitoring results (2019), number of PM_{10} 24-hour means greater than 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 2019 (%) (2)	PM_{10} 24-Hour means > 50µg/m^3 (3)				
						2015	2016	2017	2018	2019
CBI	340645	366802	Roadside	99.1	99.1	-	-	8	4	9
FMH	352445	378031	Urban background	93.0	93.0	1	0	0	0	1
LR	339947	375889	Urban background	-	-	0	0	0	0	-
TLP	344103	374330	Industrial	98.3	98.3	0 (22)	0	2	0	3

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%).

Figure 6 – Trends in number of 24-hour mean PM_{10} results greater than 50µg/m³

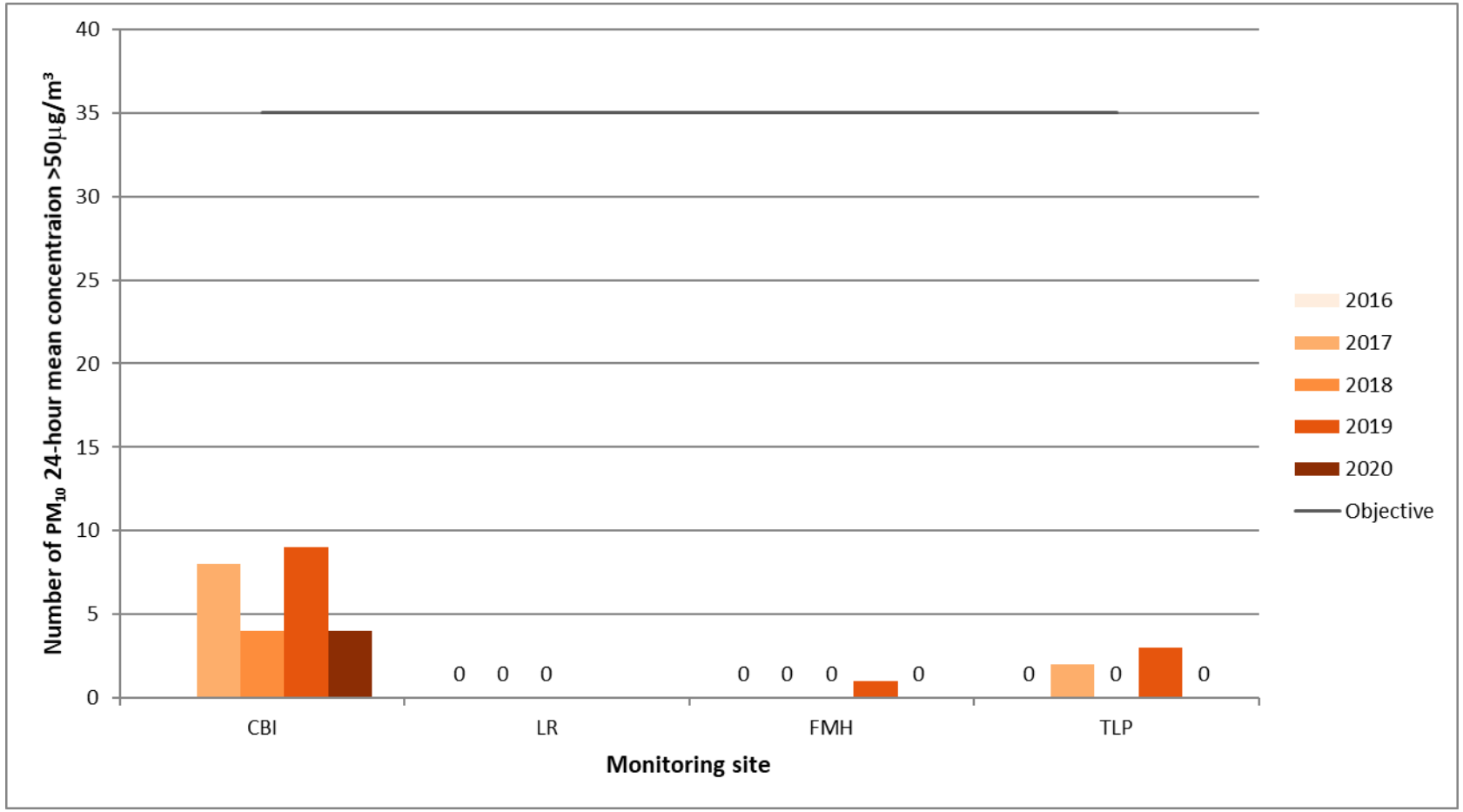


Table 14 – SO_2 2020 monitoring results, number of relevant instances

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2020 (%) (2)	Number of 15-minute Means > 266µg/m³	Number of 1-hour Means > 350µg/m³	Number of 24-hour Means > 125µg/m³
ELT	345642	375522	Industrial	95.3	95.3	8	0	0
TLP	344103	374330	Industrial	65	93.9	21	0	0

Table 15 – SO_2 2019 monitoring results, number of relevant instances

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	Number of Exceedances 2019		
						15-minute Objective (266 µg/m³)	1-hour Objective (350 µg/m³)	24-hour Objective (125 µg/m³)
ELT	345642	375522	Industrial	97	97	22	1	0
TLP	344103	374330	Industrial	95	95	10	0	0

Notes:

Results are presented as the number of instances where monitored concentrations are greater than the objective concentration.

Exceedances of the SO_2 objectives are shown in **bold** (15-min mean = 35 allowed a year, 1-hour mean = 24 allowed a year, 24-hour mean = 3 allowed a year).

If the period of valid data is less than 85%, the relevant percentiles are 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%).

Figure 7 – Trends in SO_2 concentrations – 99.9th percentiles of 15-min means

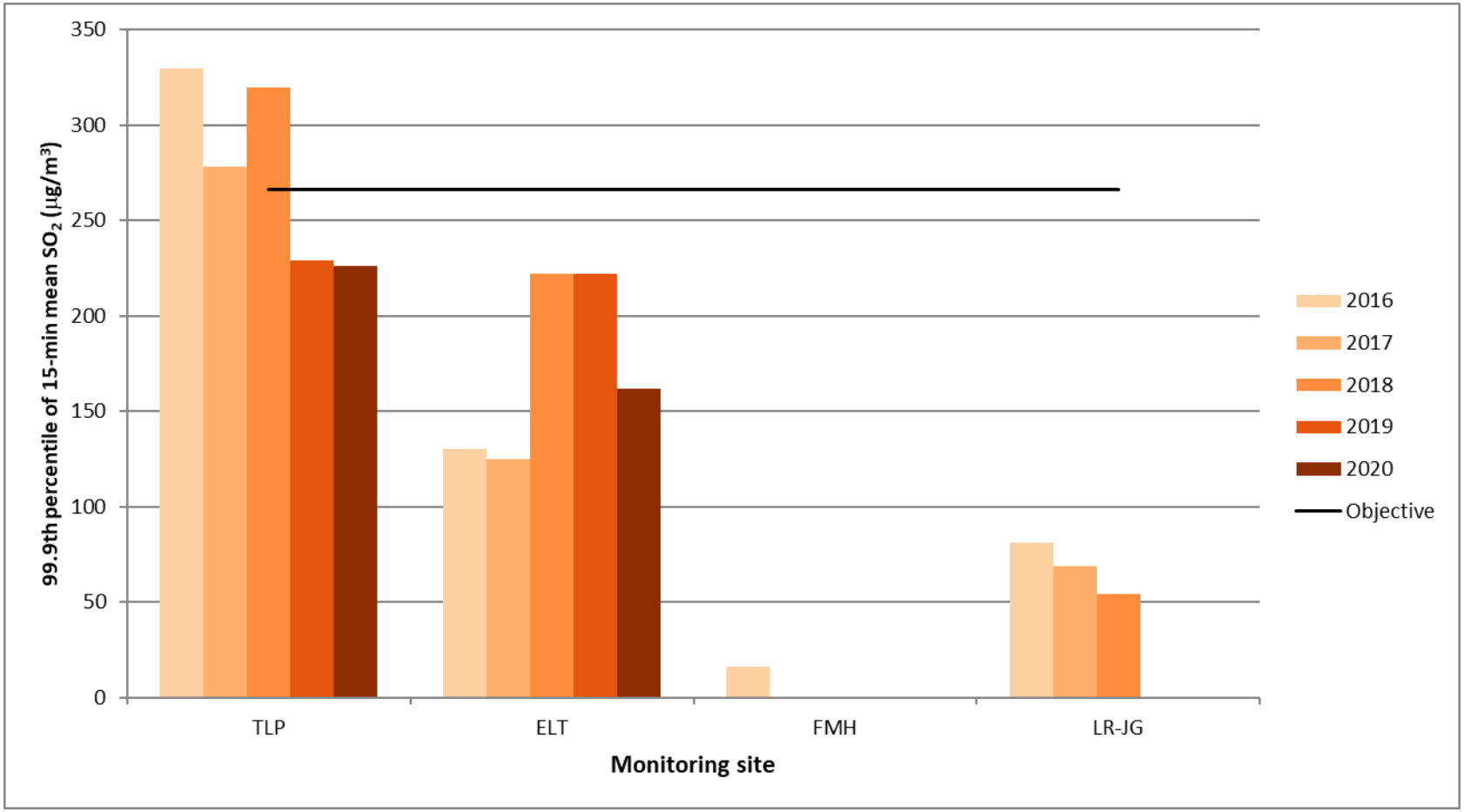
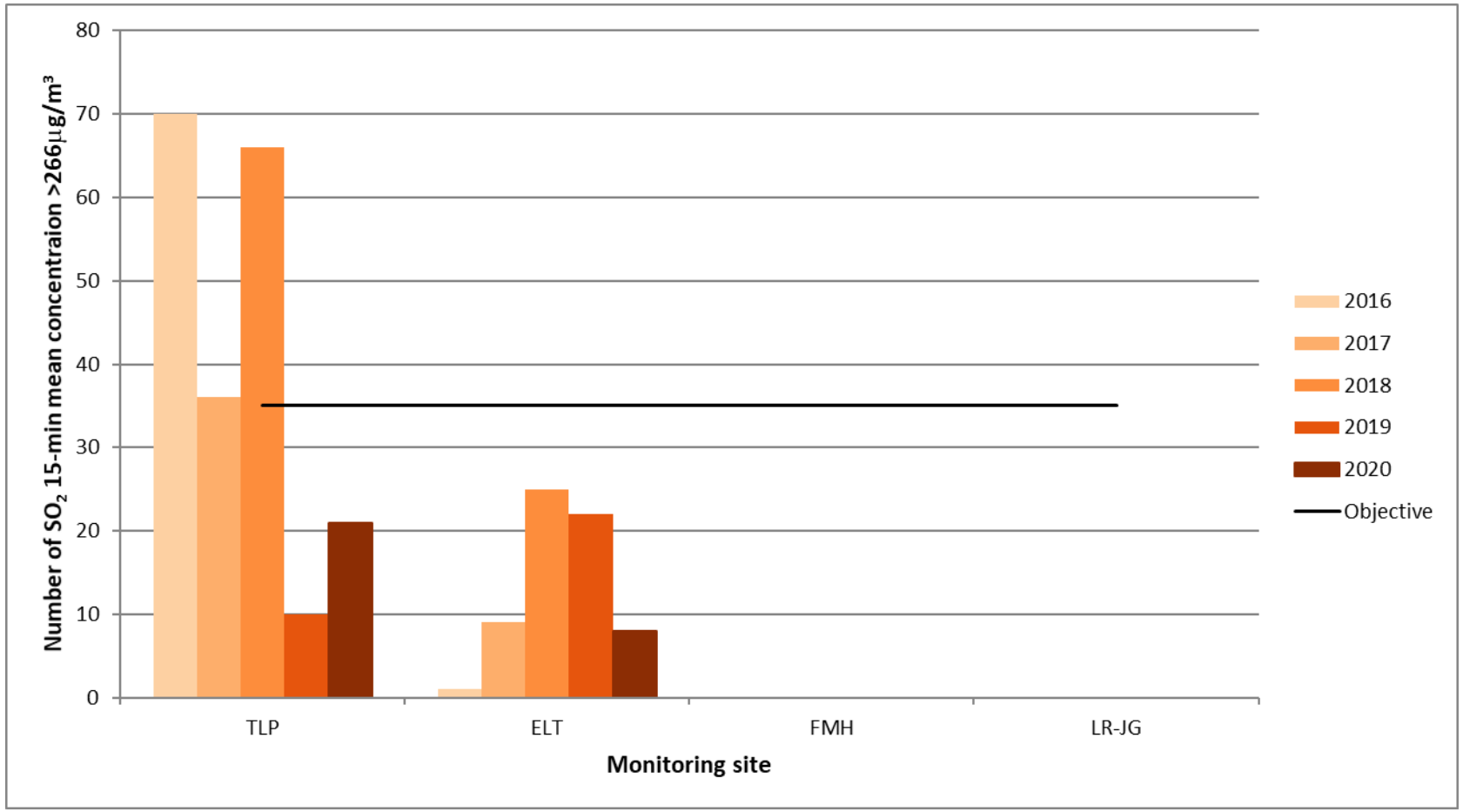


Figure 8 – Trends in SO_2 concentrations – number of 15-min means greater than 266µg/m³



Appendix B: Full monthly diffusion tube results for 2020

Table 16 – NO_2 2020 diffusion tube results ($\mu g/m^3$)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.81)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
AP	373386	371500	33.6				15.8	17.6			23.9	26.5	24.8	26.3	24.0	16.3	-	
BBC	342622	364613					14.9	19.6	11.8		23.2	16.6	22.1	22.8	18.6	14.0	-	
BE	340239	366418	38.6				13.5	21.8	23.5	27.7	29.0	27.0	30.1	36.2	27.4	22.2	-	
BJ	341401	366512	35.1				21.7	27.8	26.5	27.1	34.5	36.5	29.6	34.9	30.4	24.6	-	
BSP	338380	375840	27.7					18.7	14.7	20.6	23.7	23.3	25.0	27.7	22.8	16.2	-	
C11	341915	366427	40.9				23.8	34.4	28.3	33.1	37.4	32.7	36.2	42.9	34.3	27.8	-	
C36	342000	366374	50.9				27.2	34.6	36.0	40.6	39.0	43.4	45.1	37.9	39.2	31.8	-	
C75	342056	366354	26.2				16.3	21.1	17.5	21.7	24.0	27.0	26.1	30.1	23.4	18.9	-	
CAN	340375	366730	28.4				13.0	20.2	16.3	23.1	28.6	27.8	27.9	31.0	24.0	19.4	-	
CBI1	340647	366803	42.0				20.2	29.2	28.7	29.8	36.7	38.3	37.3	40.9	-	-	-	Triplicate Site with CBI1, CBI2 and CBI3 - Annual data provided for CBI3 only
CBI2	340647	366803	41.1				21.6	28.6	27.4	29.5	36.9	34.5	34.5	39.0	-	-	-	Triplicate Site with CBI1, CBI2 and CBI3 - Annual data provided for CBI3 only
CBI3	340647	366803	36.4				20.1	28.9	28.8	28.5	34.2	37.5	35.5	38.1	32.6	26.4	-	Triplicate Site with CBI1, CBI2 and CBI3 - Annual data provided for CBI3 only
CBR	340676	366782	40.2				17.7	26.7	22.0	28.4	34.5	32.9	33.0	36.6	30.1	24.4	-	
CFL	351762	377862	29.9				20.6	27.1	21.5	26.0	27.8	27.3	29.7	30.3	26.6	21.6	-	
CM	343761	365528	32.0				15.2	26.4	22.9	28.7	31.4	31.6	32.9	35.8	28.5	23.1	-	
CN	366070	373905	42.8				19.2	25.4	22.7	27.8	29.6	31.7	36.8	33.2	29.7	24.1	-	
CP3	343970	365295	33.5				17.2	22.4	23.3	28.2	33.2	30.4	34.4	32.9	28.3	22.9	-	
CPL	344377	365375	21.2				7.9	11.1	10.1	12.2	15.3	16.0	18.1	20.1	14.6	11.8	-	
CRH	364171	372697	23.7				10.8	13.4	11.0		16.5	18.6	22.0	23.4	17.4	12.6	-	
CVR	342930	365901	29.0				16.3	21.3	16.9	23.6	24.9	25.9	31.3	32.0	24.6	19.9	-	
DA	365953	371113	23.3				12.3	14.8	12.2	17.9	18.0	19.7	23.4	23.5	18.3	14.9	-	
EB	341658	366487	37.6				17.7	22.5	22.5	24.3	26.3	32.0	30.1	36.4	27.7	22.4	-	
FH	352146	378139	42.6				25.7	33.1	27.1	32.5	37.6	36.1	39.9	32.0	33.8	27.4	-	
FJ	352171	378140	45.4				22.6	34.3	34.6	33.2	37.2	38.6	37.3	37.2	35.3	28.6	-	
FM	352189	378094	35.6				22.6	32.2	20.2	30.0		33.6		36.2	30.1	24.3	-	
FRC	352023	378121	40.1				20.0	27.5	28.6	28.9	31.8	31.2	32.9	31.6	30.1	24.3	-	
FT	352176	378105	38.9				21.0	26.1	29.2	26.7	29.8	33.5	28.9	31.2	29.3	23.7	-	
FTG	351993	378102	37.5				19.3	26.9	20.8	27.9	26.9	28.3	30.6	31.7	27.7	22.4	-	
GE	340657	366730	35.5				14.3	23.1	16.6		30.8	30.9	34.5	36.7	27.8	20.1	-	
GR	368634	374714	25.4				14.9	18.6	15.3	20.1	20.1	23.5	26.8	24.4	21.0	17.0	-	
GSW	340700	366687	41.1				16.0	23.5	21.4		34.5	33.7		36.8	29.5	23.2	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.81)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
GT	340611	366747	35.7				16.5	26.5	20.5	27.0	32.6	29.8	33.6	34.3	28.3	23.0	-	
HB	341605	366527	37.9				16.7	23.1	18.3	25.3	27.8	27.2	30.2	34.0	26.6	21.6	-	
HHB	347953	366723	34.9				17.9	26.6			32.4	23.2	26.8	24.6	26.2	17.8	-	
HO	341311	367207	33.5				18.5	22.3	21.1	26.2	30.5	27.4	28.8	32.0	26.6	21.6	-	
HSS	364711	366339	38.3				17.3	21.6		23.9		28.9	33.7	30.4	27.4	19.2	-	
HTC	348333	366763	31.7				19.6	28.0	23.6		29.4		32.4	28.1	27.3	19.7	-	
HW	340881	366826	39.7				17.2	25.8			37.1	32.4	32.2	35.0	31.1	21.1	-	
IC	342068	366332	39.2				17.7	25.1	24.7	26.3	30.7	30.5	35.8	35.2	29.3	23.7	-	
KR	368432	372988	42.4				20.8	26.9	22.6	30.3	32.3	36.7	40.9	36.5	32.1	26.0	-	
LH	341126	366540	36.0				20.0	27.8	28.9	25.6	35.8	31.6	18.8	30.4	28.2	22.8	-	
LI2	340354	367034	46.0				21.3	30.9	26.7	30.9	35.4	36.2	37.3	43.6	34.1	27.6	-	
LU	340838	366215	31.7				9.9	13.7	16.0	19.3	23.8	23.3	21.7	24.1	20.3	16.4	-	
LVR	340980	366315						26.0		31.9		34.0	27.7	27.3	29.6	19.7	-	
LVS	340990	366317	33.9				13.3	20.2	16.6	24.2	29.1	29.7	21.0	25.9	23.7	19.2	-	
MCC	343785	365502	38.0				19.1	28.2	24.2	30.9	33.4		35.3	36.6	30.6	22.9	-	
MUL	346258	375321	21.5				10.4	14.1	10.3	14.1	17.0	17.5	22.5	21.7	16.5	13.4	-	
NCS	339857	366460	30.5				15.0	22.8	15.2	23.8	26.0	25.6	31.8	36.0	25.2	20.4	-	
NIN	340284	366199	38.2				15.9	22.8	29.5	29.4	34.4	31.5	26.7	38.8	29.6	24.0	-	
NIS	340329	366114	27.9				15.4	24.4	19.0	29.2	31.9	26.5	30.3	31.4	26.2	21.2	-	
NSR	366796	373984	39.4				25.7	32.1	24.5	35.3	35.1	37.5	36.7	39.7	34.1	27.6	-	
NWH	365590	373904	51.3				28.9	37.8	38.1		42.6	42.1	43.8	26.8	38.4	27.8	-	
OB	341633	366510	42.3				27.6	34.1	29.1	34.7	36.7	39.3	34.5	43.0	35.7	29.0	-	
OF	340453	366853	28.2				15.1	23.6	21.7	27.7	27.9	29.3	33.0	33.1	26.6	21.5	-	
ON	340718	366815	32.7					16.7	14.8	18.6	21.2	23.4	27.2	29.9	23.1	16.5	-	
OP	340636	366770	35.4				15.4	24.2	19.7	25.7	32.4	31.0	34.3	31.4	27.5	22.3	-	
OSQ	364053	365977					24.2	30.8	22.9	32.9		35.1	31.0	33.5	30.2	23.2	-	
OVH	340770	365605	36.7				12.1	18.0	17.7	22.0	26.4	27.1	30.1	26.3	23.8	19.3	-	
OW	340623	366823	50.8					33.4		32.8	43.1	40.3	43.4	43.0	40.7	27.2	-	
PA	340313	367014	45.2				19.6	28.3	24.5	30.9	37.1	36.0	42.9	46.4	34.4	27.9	-	
PG	340322	366989	49.8				21.3	32.4	30.8	33.3	41.7	37.6	39.7	47.6	36.9	29.9	-	
QRN	330565	378063					26.0	35.5	26.5	37.8	38.1	34.2	39.0	38.3	34.4	26.6	-	
RM	340291	367108	37.1				25.5	35.1	24.4	36.6	38.2	37.0	38.9	44.3	35.3	28.6	-	
RPS	367856	372667	46.2				25.6	31.2	24.6	38.4	36.5	37.2	44.8	38.5	35.8	29.0	-	
RR	340180	376338	44.0				29.9	32.7	30.2	34.8	38.6	42.8	40.2	40.3	37.0	30.0	-	
SA	340364	366929	40.3				18.8	27.7	20.3	30.9	33.2	30.9	34.1	40.4	30.7	24.8	-	
SAB	340838	366746	36.9				17.0	24.1	23.5	28.0	32.7	32.0	29.9	35.4	28.8	23.3	-	
SF	341238	366976	40.6				17.1	21.4	16.0	25.7	30.7	28.9	31.7	31.4	26.9	21.8	-	

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Easting)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.81)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
SLW	339889	375755	22.9				15.8	20.6		22.9		23.9		26.7	22.2	16.8	-	
SMH	340243	366511	28.7							22.6	23.3	23.1	24.4	27.5	24.9	15.7	-	
SR	340435	376790	40.0				24.5	31.1	27.3	31.0	36.2	35.1	34.2	34.4	32.5	26.3	-	
ST	340794	366778	49.3				20.5	34.1	31.4	33.9	45.6	39.8	40.5	42.1	37.1	30.1	-	
SV2	339836	366620	26.1				11.7	15.5	14.5	18.0	21.2	22.5	25.3	30.0	20.5	16.6	-	
SZ	341819	366475	32.0				19.0	26.8	24.5	28.1	30.2	30.0	28.2	35.4	28.2	22.9	-	
T11	341931	366458	28.7				16.4	20.3	18.6	21.8	25.0	24.3	29.5	33.5	24.2	19.6	-	
T44	342085	366446	42.5				19.1	28.3	23.7	31.2	31.8	34.0	39.1	37.0	31.7	25.7	-	
T6	341926	366446	53.9				22.9	34.5	29.4	36.6	36.1	45.5	43.0	48.7	38.9	31.5	-	
TA	344519	366898	45.4				19.6	27.7	27.2	31.7	37.0	34.7	37.1	38.0	32.9	26.7	-	
TB	341202	366470	44.4				17.8	26.4	23.4	30.6	32.3	34.2		39.2	31.0	25.0	-	
TBV	344013	366830	53.7				26.0		35.4	38.0	42.4	40.9	41.5	37.7	39.0	28.2	-	
UN	340357	366960	33.5				16.5	24.5	16.5	26.5	28.3	27.0	30.6	34.4	26.4	21.4	-	
VXR	343365	366694					17.9	24.7	17.1		27.2	26.7	30.2	33.5	25.4	19.0	-	
WCR	342951	366029	39.7				21.3	30.0	25.0	35.8	34.2	30.5		39.5	32.0	25.8	-	
WG	340217	366209	36.4				22.1	35.4	32.2	35.2	35.6	34.7	32.5	40.0	33.7	27.3	-	
WGW	340165	366198	30.1				22.2	31.4	26.6	30.9	33.2	31.3	29.5		29.3	23.7	-	
WH1	340196	376363	38.3				25.2	30.1	25.9	30.6	33.5	32.3	38.7	35.4	-	**-**	-	Triplicate Site with WH1, WH2 and WH3 - Annual data provided for WH3 only
WH2	340196	376363	37.3				21.0	28.3	24.5	31.0	34.9	33.3	36.3	35.7	-	**-**	-	Triplicate Site with WH1, WH2 and WH3 - Annual data provided for WH3 only
WH3	340196	376363					25.3	29.2	24.4	31.0	35.2	35.0	35.5	35.9	31.8	25.8	-	Triplicate Site with WH1, WH2 and WH3 - Annual data provided for WH3 only
WVC	365788	373744	28.7				12.8	16.4	12.1	19.0	19.5	22.2	24.5	35.9	21.4	17.3	-	
XR	343117	365949	30.6				17.5		21.0		28.5	27.7	30.6	28.3	26.1	18.2	-	

☒ All erroneous data has been removed from the NO_2 diffusion tube dataset presented in the table above

☒ Annualisation has been conducted where data capture is <75% and >33% in line with LAQM.TG16

☒ National bias adjustment factor used

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

☒ Cheshire West and Chester confirm that all 2020 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.

Table 17 – NO_2 2019 diffusion tube results (µg/m^3)

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	NO_2 Mean Concentrations (µg/m^3)													
														Annual Mean		
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Raw Data	Bias Adjusted (0.93) and Annualised (1)	Distance Corrected to Nearest Exposure (2)
AHH	373255	371475	27.1	27.4	13.2	27.3	17.9	17.1	9.3	12.7	16.2	24.4	31.3	20.5	20.4	18.9	
AP	373386	371500	23.4	34.4	31.6	16.5	26.0	24.2	16.8	28.2	24.7	31.4	25.8	25.8	25.7	23.9	
BE	340239	366418	44.1	37.9	36.4	35.4	30.6	32.5	19.1	26.3	35.1	34.1	45.9	36.4	34.5	32.1	
BJ	341401	366512	48.7	38.9	43.4	35.3	37.3	31.9	14.5	28.2	40.3	34.2	51.4	33.3	36.5	33.9	
BO	341864	366444	missing	missing	28.5	27.8	21.6	24.0	15.1	18.0	25.2	23.1	37.6	27.9	24.9	23.1	
C11	341915	366427	49.7	38.7	38.3	57.0	40.5	44.7	missing	29.3	44.1	39.9	65.8	37.2	44.1	41.0	
C36	342000	366374	63.9	55.6	48.7	53.3	41.1	35.9	29.9	44.1	48.6	44.7	51.9	48.2	47.2	43.9	42.3
C75	342056	366354	34.6	28.4	28.2	38.0	24.9	25.3	11.8	missing	28.5	26.8	40.3	24.9	28.3	26.4	
CAN	340375	366730	40.8	35.1	30.1	37.2	30.2	30.0	missing	missing	31.8	33.5	40.9	25.7	33.5	31.2	
CBI1-3	340647	366803	46.5	40.0	45.4	40.1	36.6	39.4	18.6	34.1	41.8	39.1	45.7	41.8	39.1	36.4	
CFL	351762	377862	37.9	33.0	27.2	36.7	31.1	missing	29.8	26.0	33.8	35.2	34.5	28.1	32.1	29.9	
CM	343761	365528	47.9	36.4	36.4	40.6	29.6	30.3	24.0	21.9	35.6	40.6	45.2	32.4	35.1	32.6	
CN	366070	373905	44.4	43.5	35.2	29.8	missing	31.5	15.4	29.4	31.2	37.2	35.7	missing	33.3	31.0	
CP3	343970	365295	44.7	33.4	36.8	35.0	29.1	27.8	14.1	29.4	33.2	35.3	46.1	33.7	33.2	30.9	
CPL	344377	365375	29.0	20.3	20.5	19.5	16.4	17.6	11.2	12.2	19.9	20.5	29.3	18.6	19.6	18.2	
CVR	342930	365901	42.1	34.2	25.7	39.5	28.0	void	12.0	24.6	30.3	27.7	32.6	32.3	29.9	27.8	
DA	365953	371113	30.9	27.0	19.5	23.0	19.7	17.9	10.0	14.4	missing	25.2	void	18.1	20.6	19.1	
DEL	355255	368416	26.6	23.6	18.4	24.9	16.2	void	15.9	14.1	17.5	20.2	29.6	17.7	20.4	19.0	
DSP	351627	364552	37.0	29.2	23.1	28.1	21.7	18.2	12.3	18.5	23.6	25.7	28.4	14.8	23.4	21.8	
EB	341658	366487	46.2	36.3	35.4	28.2	28.6	27.7	17.5	26.1	33.6	35.4	45.6	35.2	33.0	30.7	
FGS	340859	366388	37.5	31.1	29.7	33.9	26.9	31.3	15.0	21.6	32.3	29.6	40.5	26.5	29.7	27.6	
FH	352146	378139	46.8	48.2	34.9	48.1	38.0	37.3	36.4	34.7	35.2	40.5	38.2	37.6	39.7	36.9	36.5
FJ	352171	378140	46.8	44.3	49.3	35.3	36.7	35.2	37.2	34.8	36.5	41.3	39.6	38.7	39.6	36.9	35.9
FM	352189	378094	36.9	36.6	30.6	41.0	33.5	35.6	14.3	21.9	34.0	34.4	31.8	28.3	31.6	29.4	
FRC	352023	378121	missing	38.4	39.2	36.0	34.0	31.5	30.5	23.9	33.6	35.0	35.7	28.8	33.3	31.0	
FT	352176	378105	43.1	35.1	36.3	28.8	30.1	32.2	missing	30.6	33.8	missing	21.8	28.4	32.0	29.8	
FTG	351993	378102	38.3	33.8	33.4	37.1	32.4	32.5	26.9	26.7	missing	35.8	36.6	28.6	32.9	30.6	
GB	364619	372594	26.0	23.1	15.4	15.4	14.4	15.3	8.0	8.8	16.7	20.0	26.9	16.8	17.2	16.0	
GE	340657	366730	41.1	40.7	31.3	36.2	28.0	29.8	14.9	28.7	34.5	32.3	40.3	38.7	33.0	30.7	
GR	368634	374714	29.8	29.1	21.6	23.3	19.8	20.7	9.4	19.9	21.6	25.8	30.9	26.2	23.2	21.6	
GSW	340700	366687	45.2	40.3	missing	36.2	27.1	29.4	missing	30.6	40.0	34.1	44.5	36.9	36.4	33.9	
GT	340611	366747	missing	38.1	32.9	missing	30.3	33.8	11.7	30.8	35.6	36.5	42.2	35.9	32.8	30.5	
HB	341605	366527	43.6	36.0	33.0	33.1	26.2	29.6	23.1	28.4	31.8	33.9	44.4	36.1	33.3	30.9	
HHB	347953	366723	43.2	35.5	45.4	35.7	33.7	34.2	13.1	33.5	37.9	35.3	void	31.7	34.5	32.1	
HHS	349518	375954	33.1	23.9	29.0	28.1	19.8	19.3	19.6	15.7	21.8	24.2	22.8	19.2	23.0	21.4	

HO	341311	367207	38.0	38.5	27.1	32.7	27.7	30.9	12.1	27.1	33.1	31.4	37.9	32.9	30.8	28.6	
HTC	348333	366763	45.1	45.2	33.9	41.4	24.8	void	16.8	29.2	34.3	35.0	51.0	35.9	35.7	33.2	
HW	340881	366826	39.0	40.9	35.6	39.9	28.9	29.1	13.8	24.8	missing	41.6	48.8	36.1	34.4	32.0	
IC	342068	366332	52.5	40.5	41.7	34.3	27.0	32.8	missing	27.4	36.7	34.7	43.2	37.5	37.1	34.5	
KR	368432	372988	50.2	47.3	31.6	30.1	void	void	19.6	27.7	30.4	34.1	void	40.4	34.6	32.2	
LH	341126	366540	45.3	34.3	37.5	32.5	void	34.7	22.8	29.3	40.1	30.8	14.1	29.8	31.9	29.7	
LI2	340354	367034	53.7	48.5	40.4	43.9	36.3	41.2	21.4	31.9	40.1	45.3	52.2	46.5	41.8	38.8	30.3
LU	340838	366215	37.9	27.6	31.6	20.3	22.5	22.9	11.2	24.2	26.6	29.3	missing	31.3	26.0	24.1	
LVR	340980	366315	48.7	missing	missing	missing	33.3	35.9	24.6	32.5	39.8	31.9	void	39.1	35.7	34.9	
LVS	340990	366317	42.9	34.2	35.5	30.5	27.2	29.4	16.5	26.1	34.6	27.6	void	29.9	30.4	28.3	
MCC	343785	365502	56.1	40.3	39.5	45.3	35.1	44.2	18.1	31.2	39.7	41.3	51.9	34.0	39.7	36.9	35.8
MOS	341245	369610	34.9	31.3	25.0	30.3	missing	21.7	10.6	19.7	28.6	29.3	missing	28.4	26.0	24.2	
MUL	346258	375321	-	24.5	20.8	19.0	12.1	13.0	11.8	14.3	16.8	22.5	22.9	21.3	18.1	16.8	
NCS	339857	366460	40.0	39.0	27.6	35.9	24.9	26.1	10.7	22.0	27.2	32.9	40.0	33.0	29.9	27.8	
NIN	340284	366199	48.0	36.8	48.2	30.2	31.2	37.2	18.3	missing	39.8	30.9	43.9	36.1	36.4	33.9	
NIS	340329	366114	37.9	32.2	29.9	39.3	29.1	32.0	11.1	21.2	34.3	32.9	46.5	28.1	31.2	29.0	
NSR	366796	373984	43.6	43.2	39.6	44.4	39.9	37.9	15.3	24.7	37.8	38.6	57.4	33.4	38.0	35.3	
NWH	365590	373904	48.3	57.2	45.7	41.3	44.2	47.0	21.4	45.3	44.7	47.7	52.0	43.7	44.9	41.7	33.2
OB	341633	366510	51.3	missing	40.4	46.2	32.4	39.3	17.1	29.0	45.6	43.8	void	42.6	38.8	36.1	35.0
OF	340453	366853	34.5	38.6	28.4	36.9	28.3	32.7	15.2	31.8	35.7	37.2	37.1	38.7	32.9	30.6	
ON	340718	366815	-	-	-	-	-	-	12.8	20.9	23.6	25.9	36.0	34.1	25.5	23.3	
OP	340636	366770	43.9	missing	34.5	missing	29.4	33.7	14.3	27.8	37.2	31.1	43.5	35.6	33.1	30.8	
OSJ	363781	366198	30.5	26.2	17.6	missing	18.4	19.8	17.2	14.2	23.0	27.0	missing	22.1	21.6	20.1	
OW	340623	366823	57.8	56.9	53.5	49.8	40.3	40.6	29.9	40.9	41.2	48.2	47.3	52.4	46.6	43.3	38.9
PA	340313	367014	48.1	60.3	missing	42.6	35.4	42.3	21.4	38.6	48.0	44.6	46.5	48.5	43.3	40.3	33.0
PG	340322	366989	52.2	49.7	41.5	43.7	missing	40.5	20.8	39.2	missing	missing	56.9	50.6	43.9	40.8	
RM	340291	367108	missing	50.1	33.1	43.3	41.3	43.7	16.4	30.6	41.7	51.4	61.6	45.7	41.7	38.8	
RPS	367856	372667	46.9	58.5	40.7	52.0	32.5	40.6	10.7	42.1	43.3	48.7	59.1	48.0	43.6	40.5	27.9
RR	340180	376338	47.6	40.4	42.3	42.5	missing	35.2	19.0	32.6	39.7	35.8	44.4	36.4	37.8	35.2	
SA	340364	366929	45.2	44.3	21.1	45.2	31.9	38.5	13.5	29.6	38.6	40.3	52.7	43.0	37.0	34.4	
SAB	340838	366746	-	-	-	-	-	-	13.5	24.2	36.6	34.7	45.2	33.5	31.3	28.5	
SF	341238	366976	41.8	48.6	31.8	37.7	27.7	missing	13.5	31.5	33.0	missing	37.5	41.2	34.4	32.0	
SMH	340245	366499	36.3	30.7	30.8	22.4	void	missing	12.1	18.5	27.4	31.8	40.5	28.6	27.9	26.0	
SR	340435	376790	39.6	36.1	37.3	40.1	30.5	30.4	21.8	29.9	36.5	31.5	void	33.0	33.3	31.0	
ST	340794	366778	45.3	49.4	43.1	47.1	40.1	39.3	19.6	39.6	46.8	46.0	54.5	47.7	43.2	40.2	23.5
SV2	339836	366620	34.2	26.4	27.3	25.4	22.9	19.2	11.8	18.3	25.4	24.1	36.9	20.9	24.4	22.7	
SZ	341819	366475	45.2	33.4	37.5	40.9	33.8	32.4	15.5	23.4	37.0	33.8	51.3	30.5	34.5	32.1	
T11	341931	366458	41.8	34.0	31.5	36.6	24.9	27.3	11.7	24.0	31.8	32.4	40.7	32.9	30.8	28.6	
T44	342085	366446	49.0	46.2	40.5	51.2	void	37.7	15.6	28.7	40.9	44.4	46.6	43.7	40.4	37.6	30.1
T6	341926	366446	63.4	58.6	45.2	52.1	35.4	44.0	18.9	38.4	48.3	46.8	53.4	58.0	46.9	43.6	
TA	344519	366898	52.1	50.6	47.1	40.8	37.3	33.4	16.1	33.9	42.8	48.6	51.2	43.9	41.5	38.6	29.6
TB	341202	366470	47.1	35.8	33.9	44.1	31.0	28.4	15.1	29.1	38.5	38.1	46.0	42.7	35.8	33.3	
TBV	344013	366830	49.3	66.4	54.1	51.7	41.7	49.7	21.8	57.3	void	46.4	37.7	49.5	47.8	44.4	28.5

UCA	339687	375972	37.6	29.7	30.6	30.6	26.3	27.2	11.5	20.6	missing	missing	missing	26.7	26.8	24.9	
UHS	342010	369154	39.1	missing	28.8	31.0	22.8	22.7	missing	missing	23.7	missing	44.6	31.4	30.5	26.1	
UN	340357	366960	47.6	42.0	35.5	51.2	missing	36.8	14.6	21.9	31.8	37.1	47.4	31.0	36.1	33.5	
W23	343729	365561	46.5	34.2	33.9	38.3	31.4	33.1	14.5	25.2	33.6	34.3	41.1	28.5	32.9	30.6	
WCR	342951	366029	53.3	50.9	42.0	55.4	31.8	void	void	31.1	38.9	41.9	53.7	43.1	44.2	41.1	30.2
WG	340217	366209	42.3	34.9	40.3	45.9	34.4	39.7	19.0	30.4	40.5	41.8	48.8	36.1	37.8	35.2	
WGW	340165	366198	39.3	27.2	31.4	35.6	34.2	35.0	22.2	22.8	missing	32.0	45.0	25.7	31.9	29.6	
WH1-3	340196	376363	39.9	38.5	36.2	37.3	32.2	31.9	16.8	27.8	33.9	33.1	42.8	34.4	33.7	31.4	
WIM	368933	363614	36.0	38.3	17.0	26.8	32.8	34.3	15.1	23.8	32.8	35.2	41.0	25.9	29.9	27.8	
XR	343117	365949	41.0	36.9	34.5	39.5	26.9	30.0	15.2	28.8	31.4	32.1	38.4	29.0	32.0	29.7	

☒ National bias adjustment factor used

☒ Annualisation has been conducted where data capture is <75%

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

Notes:

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

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

(1) See Appendix C for details on bias adjustment and annualisation.
(2) Distance corrected to nearest relevant public exposure.

Appendix C: Supporting technical information / air quality monitoring data QA/QC

New or changed sources identified within Cheshire West and Chester during 2019 and 2020

Through the planning process, Cheshire West and Chester Council has identified a number of new sources with a potential to impact air quality, these are summarised in Table 18. The actual impacts of these sources have been deemed to be acceptable at the consultation stage either through assessment or the permitting regime.

Table 18 – New sources with a potential to impact air quality (2019-20)

Reference	Address	Proposal
19/02187/FUL	Northgate Development Northgate Street Chester	Erection of a multi-storey car park with vehicular access and associated development
19/00203/FUL	Hartford Campus Chester Road Hartford Northwich CW8 1LJ	Demolition of Mid Cheshire College and Erection of 108 dwellings
19/02452/MIN	Cemex Forest Hill Quarry Chester Road Northwich CW8 2DL	Proposed Northern Extension to the quarry (north of the railway line) for the extraction of approximately 350,000 tonnes of sand with restoration to nature conservation, including a temporary access and extension of the existing haul road across the site at Forest Hill Quarry, Chester Road, Northwich CW8 2DL
19/02320/FUL	Stagecoach Bus Depot, The Old Station Saighton Lane Saighton Chester	Bus depot comprising maintenance workshop, offices, bus re-fuelling, wash, bus parking and associated car parking
19/03126/FUL	Electricity Substation Capenhurst Lane Capenhurst Chester Cheshire	Installation of 49.5MW gas peaking plant (gas fired reserve electricity generation)
19/02423/FUL	Dock Yard Power Land at Dock yard Road Ellesmere Port	Construction and operation of an urban reserve 2.5MW gas fired power plant associated equipment
19/03230/FUL	Land at Former Van Leer UK Meadow Lane Ellesmere Port Cheshire	Residential Development for 127 no. houses and 60 no. apartments along with associated infrastructure.
19/03489/FUL	Area 10B Ince Resource Recovery Park Grinsome Road Ellesmere Port	Development of a hydrogen production facility and electricity generating plant, comprising of a waste reception and handling building, gasification facility, hydrogen production facility with associated/ ancillary infrastructure which includes access roads, weighbridge, fencing / gates, lighting, surface water drainage, and electricity distribution plant

19/03573/FUL	Land at Smokehall Lane and Deakins Road Winsford Cheshire	Erection of 138 dwellings, provision of a new vehicular access, car parking, roads and footways, landscaping, Public Open Space, drainage, substation and other associated works
19/03737/FUL	Land West of Chapterhouse Close Ellesmere Port	Proposed Gas Peaking Plant with a generating capacity of up to 49.9MW, Substation, Step-Up Transformer and Ancillary Development.
20/00324/FUL	Land at Cable Drive Helsby Frodsham	Demolition of existing buildings and erection of 247 dwellings and apartments with access road and associated external works
20/03277/FUL	CHP Plant Bridgewater Paper Mill North Road Ellesmere Port CH65 1AG	Reserve electricity generation site with a generating capacity of 20MW. The development comprises up to 10 gas engine generators within steel containers, one transformer, one electrical container, two spare containers and two lube oil tanks (current planning permission (17/01517/FUL) for this development expired in July 2020 and thus this is an application for a new planning permission for the development)
20/00742/FUL	Playing Fields Off Grange Lane Winsford	The erection of 268 dwellings, provision of a new vehicular access and associated infrastructure, landscaping, sports pitches, public open space, ecological habitat and ancillary works.
19/04277/FUL	Doubletree by Hilton Warrington Road Hoole Village Chester CH2 3PD	Installation of a combined heat and power unit in acoustic enclosure with radiator and flue

Additional air quality works undertaken by Cheshire West and Chester during 2019/2020

Cheshire West and Chester has not completed any additional works within the reporting years of 2019/2020.

QA/QC of diffusion tube monitoring

Council staff follow internal QA/QC procedures relating to the use of diffusion tubes for the purpose of air quality monitoring. These cover key stages in the monitoring process including storage, deployment, record keeping and management of NO_2 diffusion tube data.

NO_2 diffusion tubes are supplied and analysed by Gradko Ltd laboratory which holds UKAS accreditation. The method of preparation is 20% TEA in water. Gradko participate in the AIR NO_2 Proficiency Testing Scheme and their performance is publicly available on the Defra website. In rounds AR030, 31, 33, 34, 36 and 40 (2019 to 2020) Gradko achieved a

satisfactory result of 75% or above. In common with other analytical laboratories no results were reported for rounds 37 and 38 as a consequence of lockdown restrictions.

Cheshire West and Chester monitoring has been completed in adherence with the Defra diffusion tube monitoring calendars for exposure dates. However, as stated elsewhere, lockdown restrictions resulted in no valid data for February-April 2020 inclusive.

Diffusion tube annualisation

Annualisation is required for any site with data capture less than 75% but greater than 33%. 2020 data from 26 non-automatic monitoring sites were annualised, as shown in Table 20. The Diffusion Tube Data Processing Tool was used for these calculations.

Diffusion tube bias adjustment factors

The diffusion tube data presented within the 2020/21 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.TG16 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.

Cheshire West and Chester have applied a national bias adjustment factor of 0.81 to the 2020 monitoring data and a factor of 0.93 to the 2019 data. A summary of bias adjustment factors used by Cheshire West and Chester over the past five years is presented in Table 20.

The overall accuracy and precision of the two local studies (sites CBI and WH) were good, as were data capture rates for the automatic analysers (see Table 21). There were however just 9 periods of diffusion tube data available due to lockdown restrictions. The combined local factor was 0.87, which is higher than the national factor of 0.81. As in previous years, and in line with the guidance notes in section 7.175 of LAQM.TG16, it has been decided to use the national bias adjustment factor (0.81) for the adjustment of all diffusion tube data as it is likely to be more statistically reliable.

Table 19 – Bias adjustment factor

Year	Local or National	If National, Version of National Spreadsheet	Adjustment Factor
2020	National	06/21	0.81
2019	National	03/20	0.93
2018	National	03/19	0.93
2017	National	03/18	0.89
2016	National	09/17	0.92

NO_2 Fall-off with distance from the road

Wherever possible, local authorities should ensure that monitoring locations are representative of exposure. However, where this is not possible, the NO_2 concentration at the nearest location relevant for exposure should be 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 16 and Table 17.

No diffusion tube NO_2 monitoring locations within Cheshire West and Chester required distance correction during 2020.

For 2019 monitoring, however, distance corrections were applied to data greater than 36$\mu g/m^3$ from15 sites that are not representative of residential exposure. The affected sites were: C36, FH, FJ, LI2, MCC, NWH, OB, OW, PA, RPS, ST, T44, TA, TBV and WCR.

QA/QC of automatic monitoring

Council staff perform fortnightly span and zero calibrations on the chemiluminescent analysers at the BO, CBI and WH roadside sites, and four-weekly span and zero calibrations on the remaining chemiluminescent and UV-fluorescent analysers, using BOC spectra-seal certified gas standards. The resultant span and offset values are used in the ratification of datasets. Automated internal zero checks are run overnight daily. Data from different sites is compared on a regular basis for the purposes of QA/QC. Data management and ratification is performed by an independent contractor, AQDM Ltd. This includes production of weekly, quarterly and annual summaries as well as ad hoc notifications of any exceedance episodes where necessary. The ratification process also

involves comparison against national network sites to identify regional patterns and trends. Automatic analysers are serviced and calibrated at six-monthly intervals by Enviro Technology Services Ltd.

Currently, air quality monitoring data is publicly available at: www.cheshirewestandchester.gov.uk/airquality. This includes daily updates of automatic monitoring data, presented as both air quality index gauges and time series graphs but it lacks the facility to download historical datasets. Diffusion tube data is also available on the site. However, the Council has commissioned a third-party contractor to create a replacement air quality website with a much-improved interface for the end user. This will be launched later in 2021.

PM_{10} and $PM_{2.5}$ monitoring adjustment

PM_{10} monitoring data recorded by the BAM analysers at Thornton-le-Moors (TLP) and Chester bus interchange (CBI) have been adjusted by the factor 0.96618, to give the indicative gravimetric equivalent figure.

The volatile correction model (VCM) was used to correct TEOM monitoring data at Frodsham (FMH) to produce a gravimetric equivalent figure.

Automatic monitoring annualisation

All automatic monitoring locations within Cheshire West and Chester 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 33% do not require annualisation.

NO_2 Fall-off with distance from the road

No automatic NO_2 monitoring locations within Cheshire West and Chester required distance correction during 2019 and 2020.

Table 20 – Annualisation summary (concentrations presented in µg/m^3)

Site ID	Annualisation Factor Crewe Coppenhall	Annualisation Factor Glazebury	Annualisation Factor Wigan Centre	Annualisation Factor Wirral Tranmere	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
AP	0.9050	0.8876	0.8995	0.6696	0.8404	24.0	20.1	
BBC	0.9660	0.9956	1.0133	0.7198	0.9237	18.6	17.2	
BSP	0.9381	0.9442	0.9387	0.6929	0.8785	22.8	20.0	
CRH	0.9657	0.9429	0.9605	0.7072	0.8941	17.4	15.6	
FM	1.0546	1.0513	1.0667	0.8101	0.9957	30.1	30.0	
GE	0.9657	0.9429	0.9605	0.7072	0.8941	27.8	24.8	
GSW	1.0443	1.0117	1.0272	0.7983	0.9704	29.5	28.6	
HHB	0.9050	0.8876	0.8995	0.6696	0.8404	26.2	22.0	
HSS	0.9165	0.9216	0.9333	0.6814	0.8632	27.4	23.6	
HTC	0.9686	0.9310	0.9582	0.7032	0.8902	27.3	24.3	
HW	0.9050	0.8876	0.8995	0.6696	0.8404	31.1	26.1	
LVR	0.8357	0.9150	0.8956	0.6381	0.8211	29.6	24.3	
MCC	0.9922	0.9783	1.0024	0.7264	0.9248	30.6	28.3	
NWH	0.9657	0.9429	0.9605	0.7072	0.8941	38.4	34.3	
ON	0.9381	0.9442	0.9387	0.6929	0.8785	23.1	20.3	
OSQ	0.9770	1.0345	1.0521	0.7317	0.9488	30.2	28.7	
OW	0.8778	0.8890	0.8779	0.6552	0.8250	40.7	33.6	
QRN	0.9892	1.0378	1.0526	0.7409	0.9551	34.4	32.8	
SLW	0.9875	0.9914	0.9991	0.7713	0.9373	22.2	20.8	
SMH	0.8276	0.8454	0.8242	0.6271	0.7811	24.9	19.4	
TB	1.0593	1.0529	1.0656	0.8117	0.9973	31.0	30.9	
TBV	0.9510	0.9540	0.9602	0.7093	0.8936	39.0	34.9	

Site ID	Annualisation Factor Crewe Coppenhall	Annualisation Factor Glazebury	Annualisation Factor Wigan Centre	Annualisation Factor Wirral Tranmere	Average Annualisation Factor	Raw Data Annual Mean	Annualised Annual Mean	Comments
VXR	0.9660	0.9956	1.0133	0.7198	0.9237	25.4	23.4	
WCR	1.0593	1.0529	1.0656	0.8117	0.9973	32.0	31.9	
WGW	1.0988	1.0483	1.0966	0.7572	1.0002	29.3	29.3	
XR	0.9239	0.9069	0.9149	0.6853	0.8577	26.1	22.4	

Table 21 – Local bias adjustment calculation

	Local Bias Adjustment Input 1	Local Bias Adjustment Input 2
Periods used to calculate bias	9	9
Bias Adjustment Factor A	0.85 (0.8 - 0.91)	0.89 (0.82 - 0.96)
Diffusion Tube Bias B	18% 10% - 25%)	13% (4% - 21%)
Diffusion Tube Mean (µg/m^3)	31.9	32.8
Mean CV (Precision)	3.4%	3.9%
Automatic Mean (µg/m^3)	27.2	29.0
Data Capture	98%	98%
Adjusted Tube Mean (µg/m^3)	27 (26 - 29)	29 (27 - 31)
Overall Diffusion Tube Precision	Good Overall Precision	Good Overall Precision
Overall Continuous Monitor Data Capture	Good Overall Data Capture	Good Overall Data Capture
Combined Local Bias Adjustment Factor	0.87	

Notes:

A single national bias adjustment factor has been used in preference to the local factor to bias adjust the 2020 diffusion tube results.

Table 22 – NO_2 Fall off with distance calculations (2019) (concentrations presented in µg/m^3)

Site ID	Distance (m): Monitoring Site to Kerb	Distance (m): Receptor to Kerb	Monitored Concentration (Annualised and Bias Adjusted	Background Concentration	Concentration Predicted at Receptor	Comments
C36	1.5	1.9	43.9	13.0	42.3	Predicted concentration at receptor above AQS objective.
FH	2	2.2	36.9	16.8	36.5	Predicted concentration at receptor within 10% the AQS objective.
FJ	2	2.5	36.9	16.8	35.9	
LI2	2.5	9.5	38.8	13.0	30.3	
MCC	2.4	2.9	36.9	12.9	35.8	
NWH	0.7	3.1	41.7	11.4	33.2	
OB	2.5	3.1	36.1	14.6	35.0	
OW	2.3	4.6	43.3	16.9	38.9	Predicted concentration at receptor within 10% the AQS objective.
PA	0.8	3.2	40.3	13.0	33.0	
RPS	5.2	24.2	40.5	13.4	27.9	Warning: your receptor is more than 20m further from the kerb than your monitor - treat result with caution.
ST	0.1	18.4	40.2	16.9	23.5	
T44	1	4.5	37.6	13.0	30.1	
TA	2	8	38.6	10.9	29.6	
TBV	1.4	15.8	47.8	10.9	28.5	
WCR	1.5	8.7	41.1	13.0	30.2	

Figure 9 – Inter-site hourly NO_2 comparisons 2020 (AQDM Ltd.)

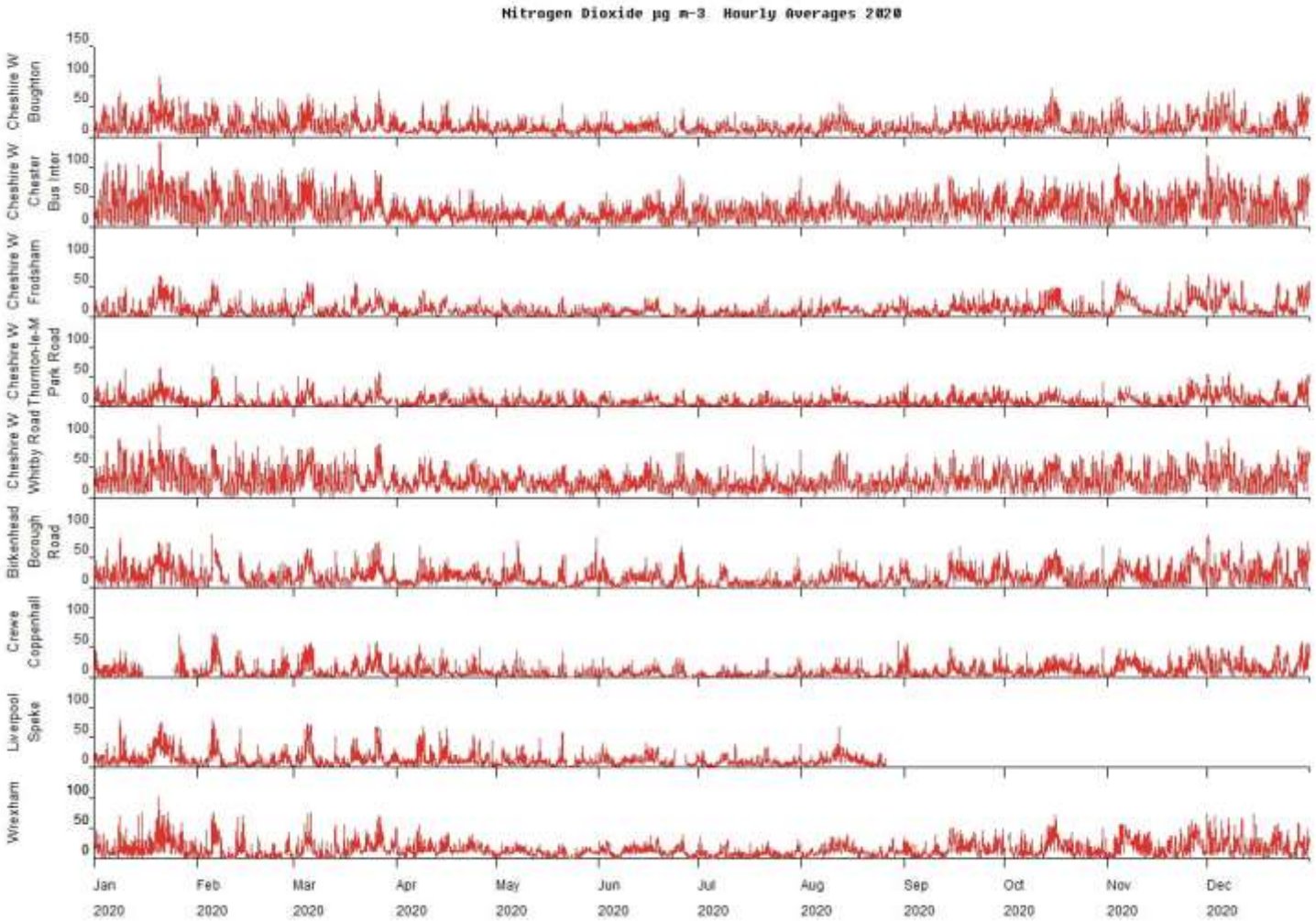


Figure 10 – Inter-site hourly NO_2 comparisons 2019 (AQDM Ltd.)

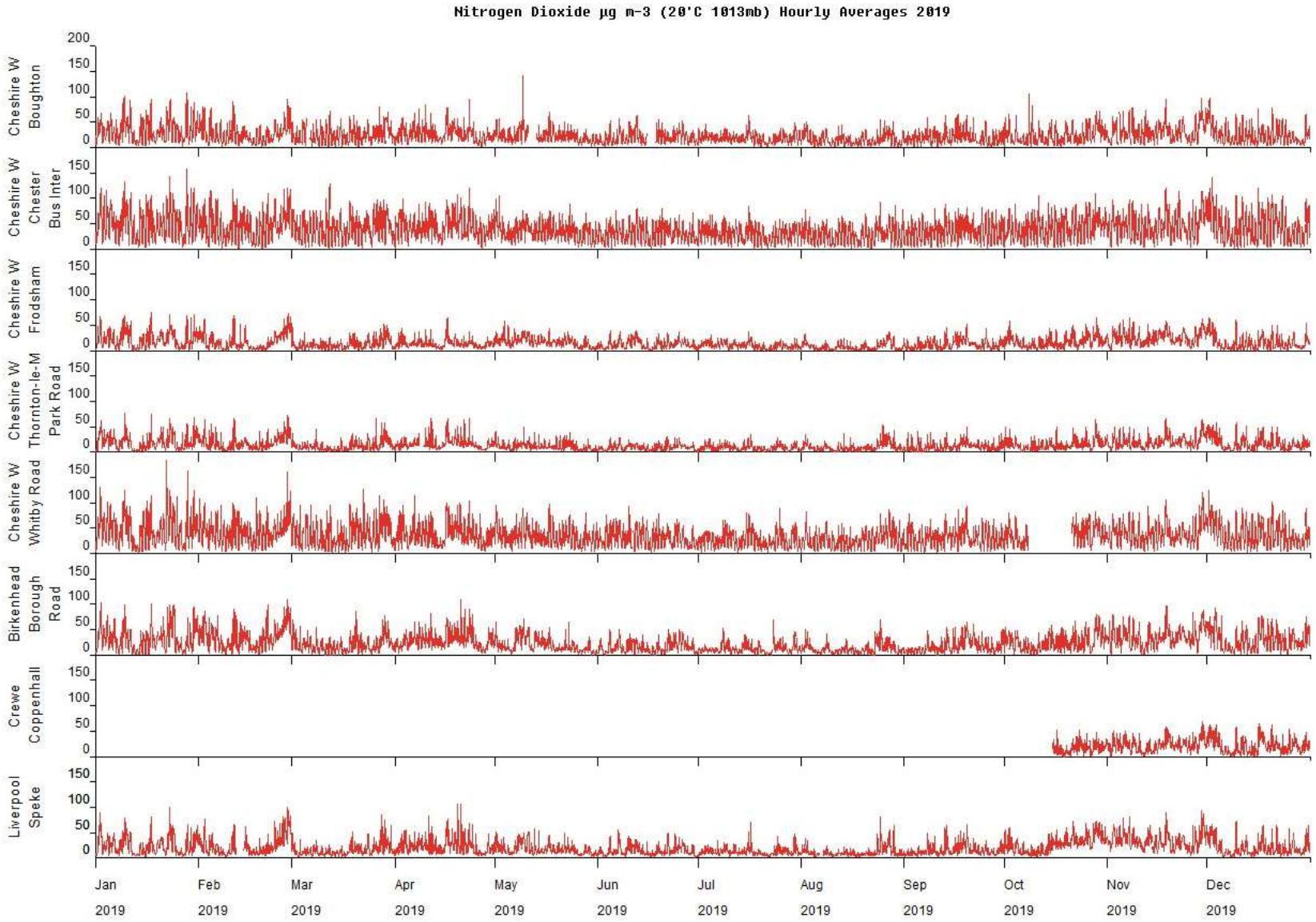


Figure 11 – Inter-site monthly NO_2 comparisons 2016-2020 (AQDM Ltd.)

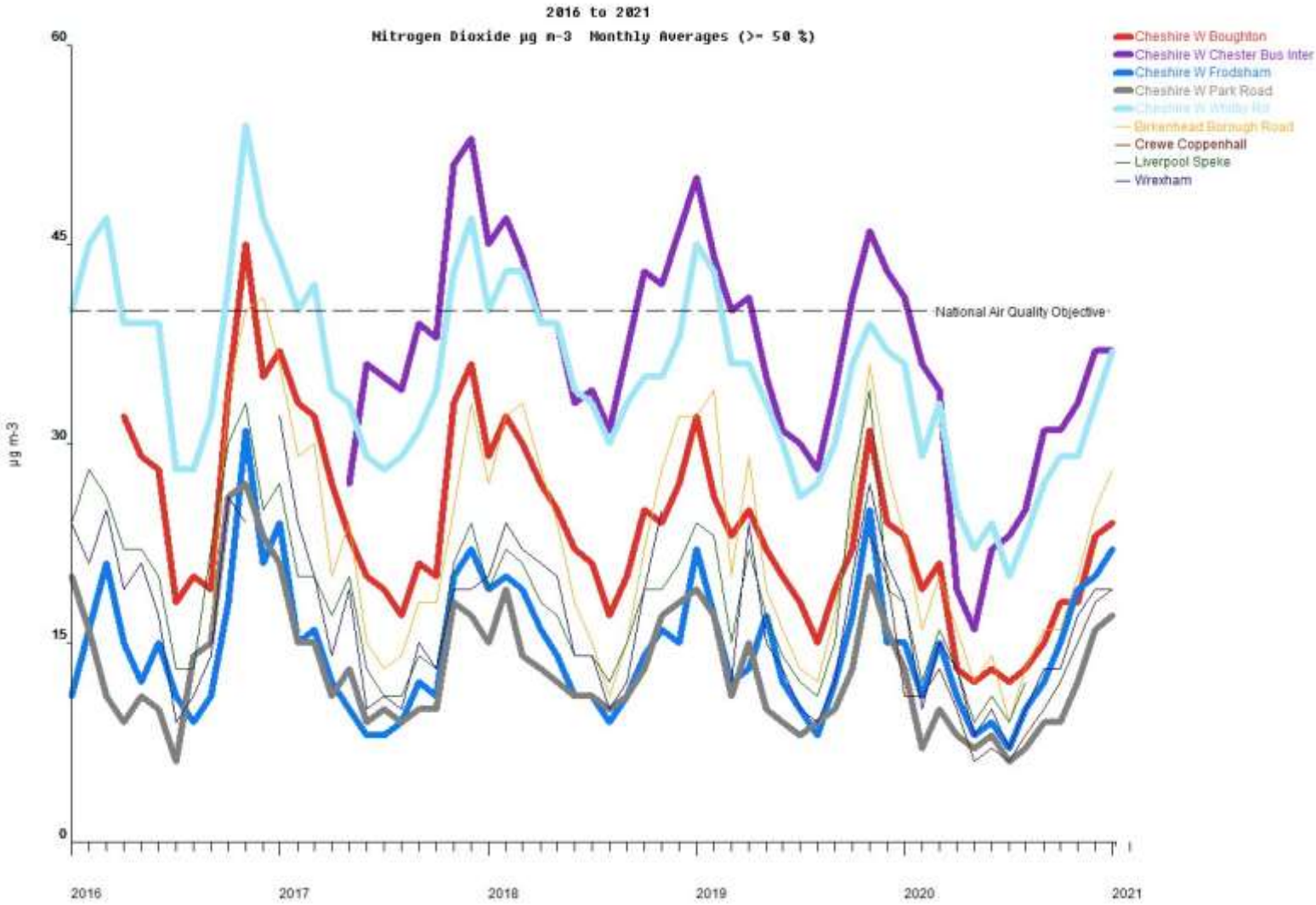


Figure 12 – Inter-site daily gravimetric PM_{10} comparisons 2020 (AQDM Ltd.)

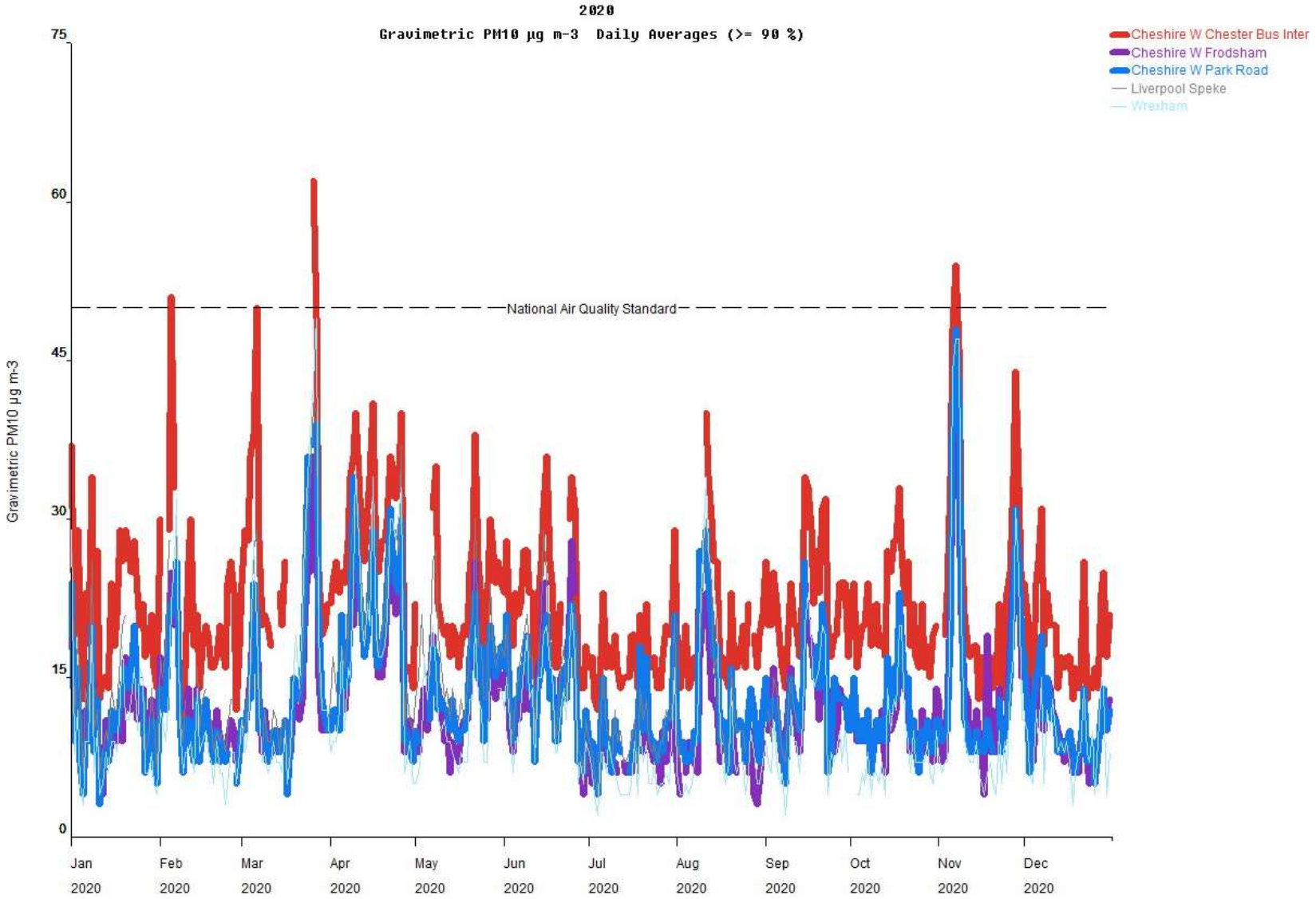


Figure 13 – Inter-site daily gravimetric PM_{10} comparisons 2019 (AQDM Ltd.)

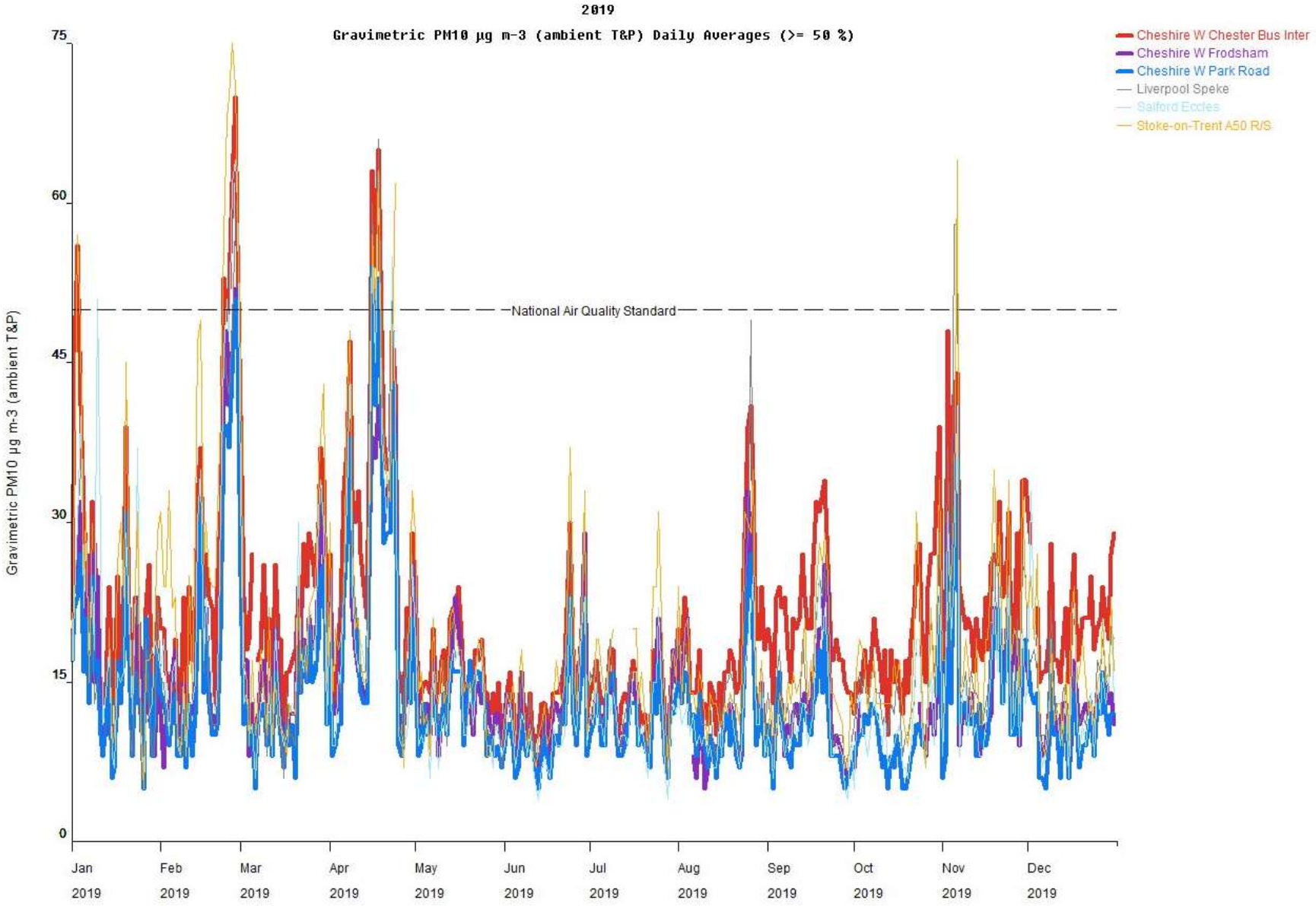


Figure 14 – Inter-site 15-minute SO_2 comparisons 2020 (AQDM Ltd.)

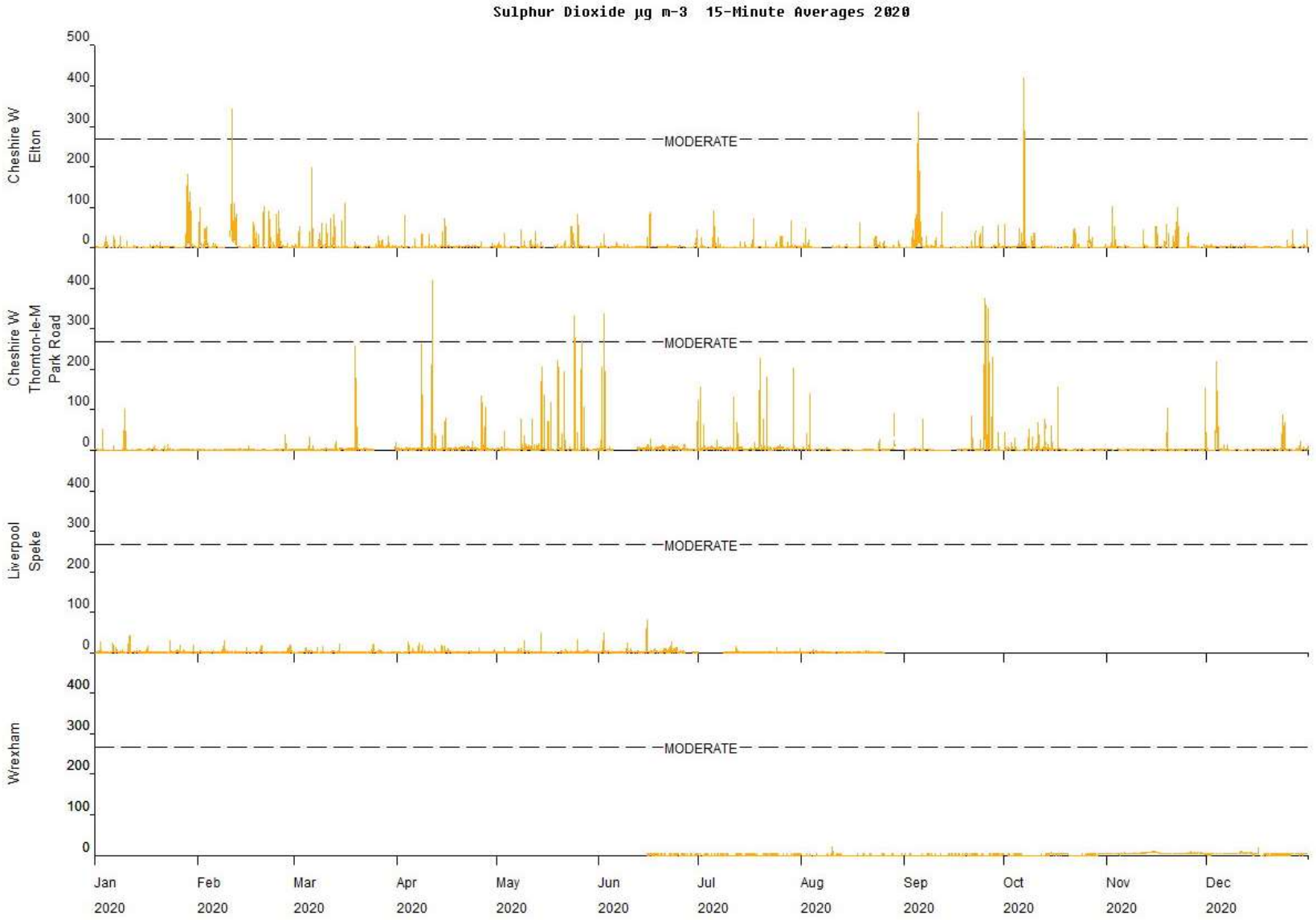


Figure 15 – Inter-site 15-minute SO_2 comparisons 2019 (AQDM Ltd.)

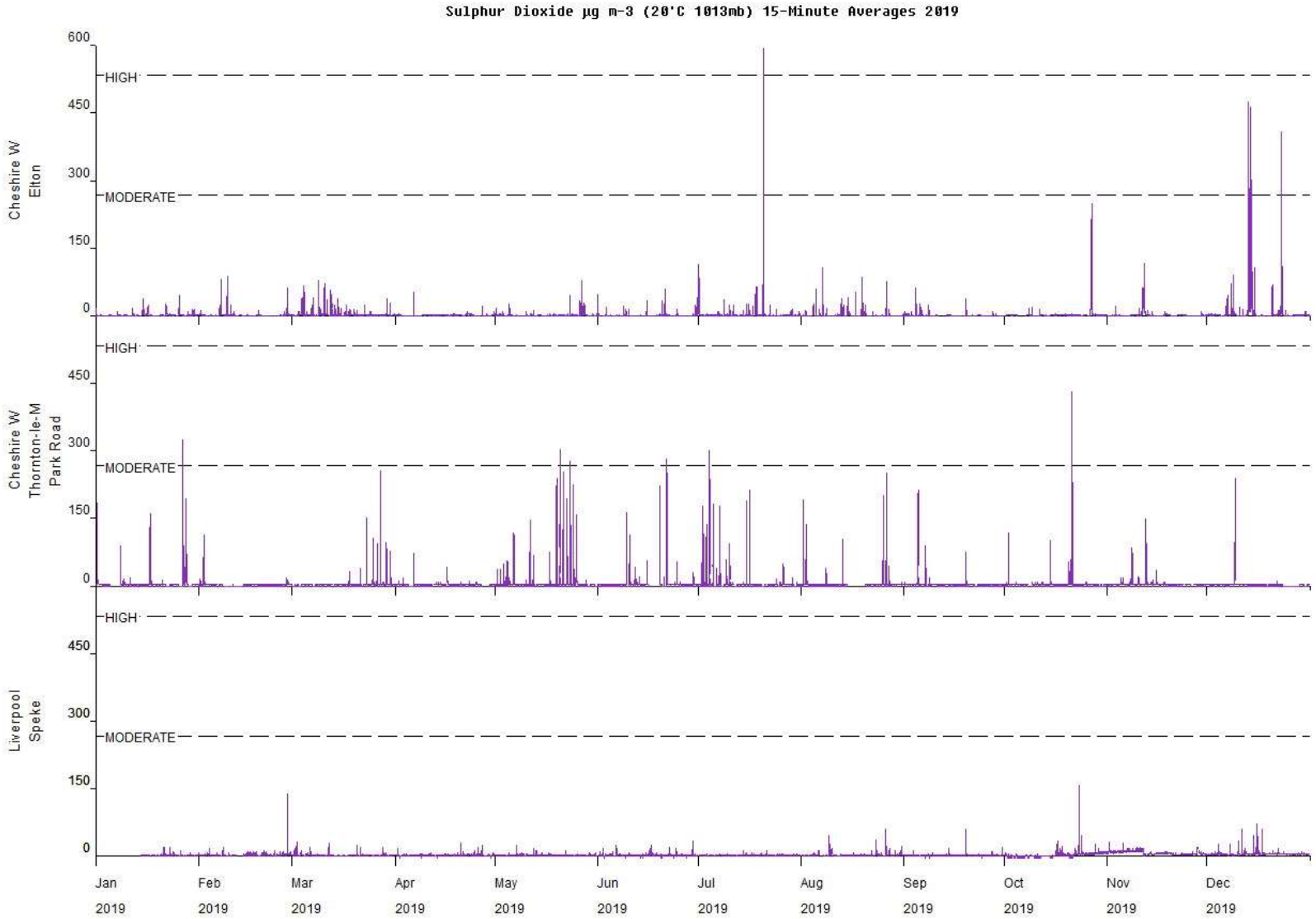
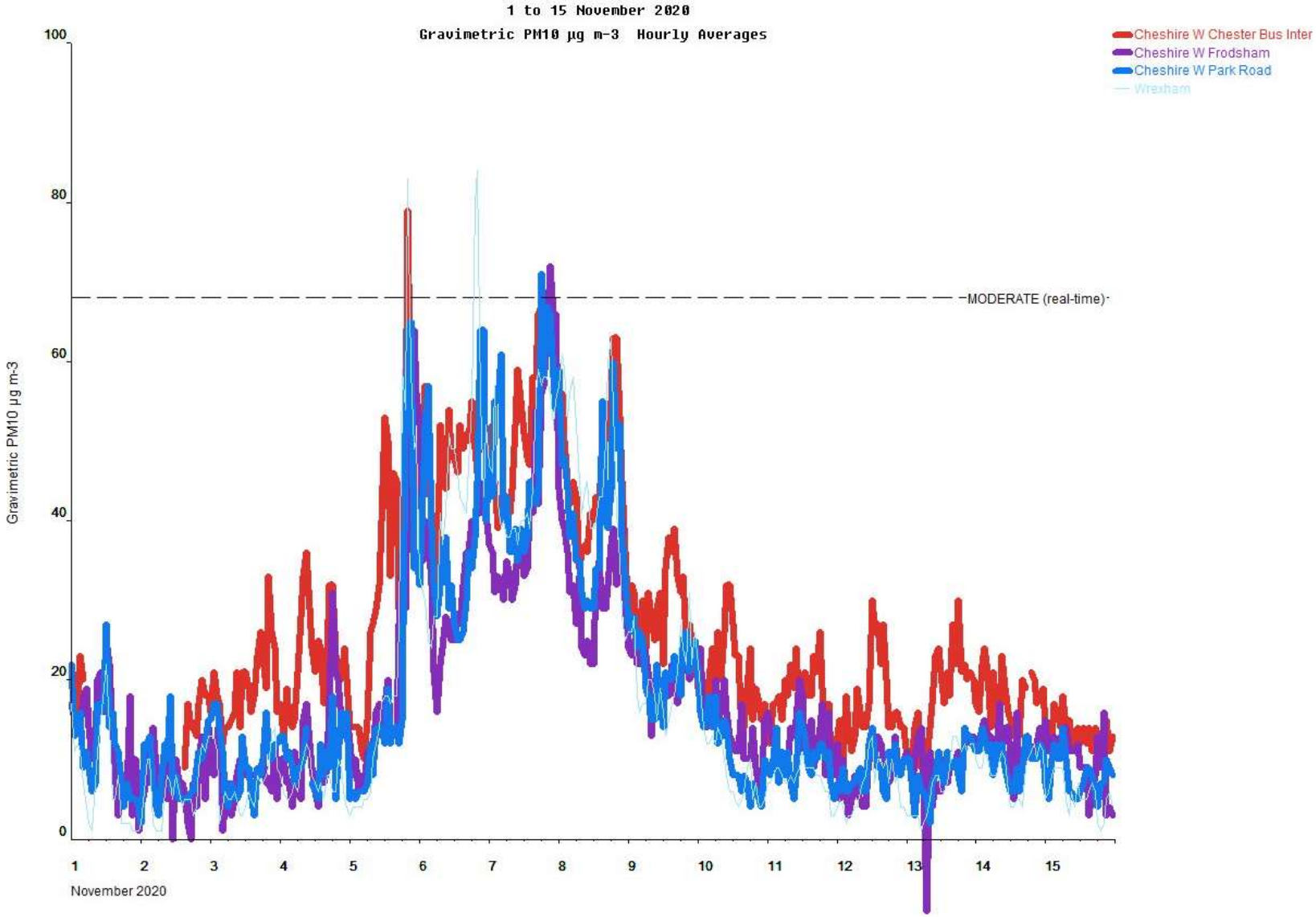


Figure 16 – PM_{10} episode November 2020 (AQDM Ltd.)



Appendix D: Map(s) of monitoring locations and AQMAs

Figure 17 – Map of monitoring sites and AQMA, Chester

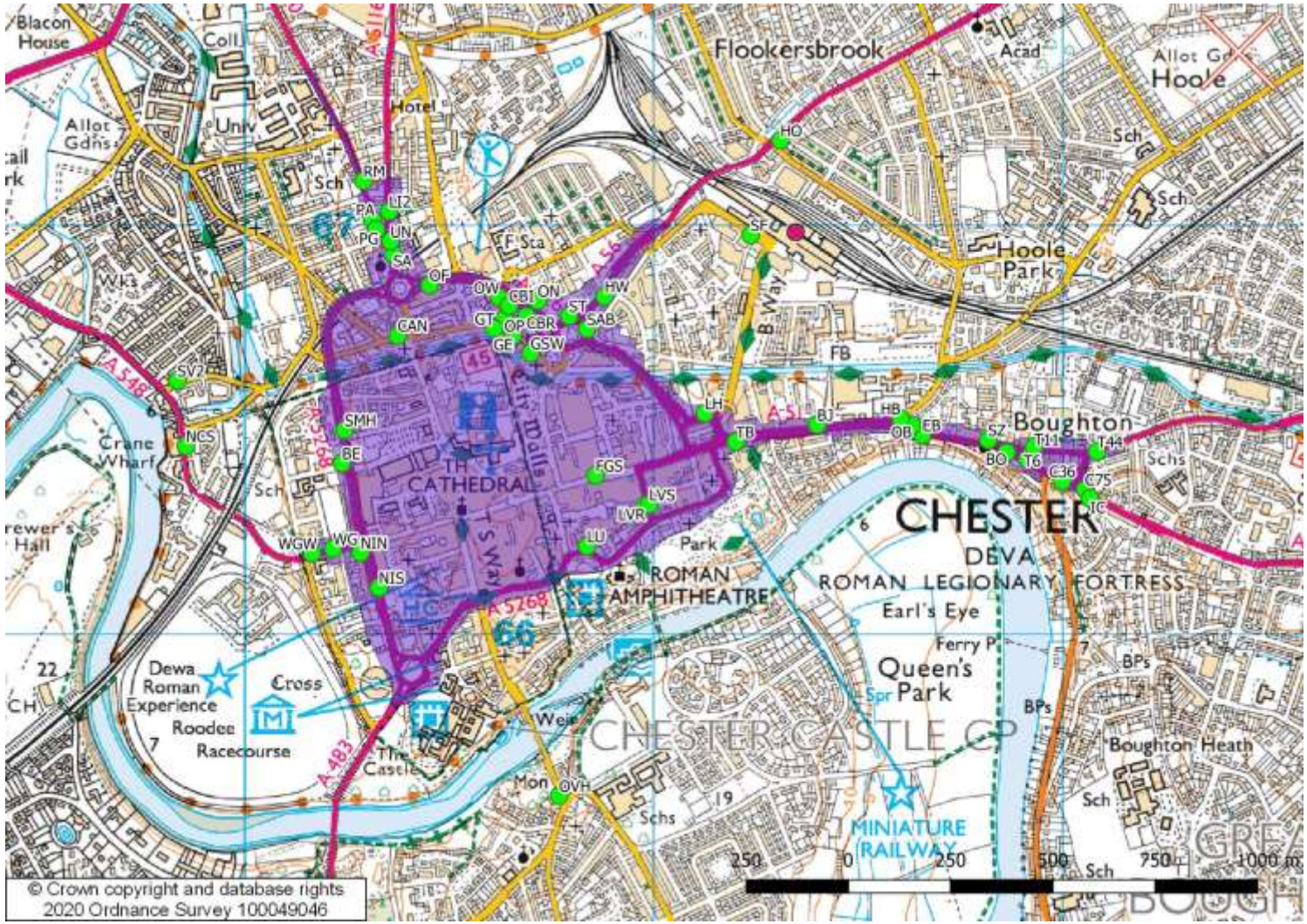


Figure 18 – Map of monitoring sites and AQMA, Ellesmere Port

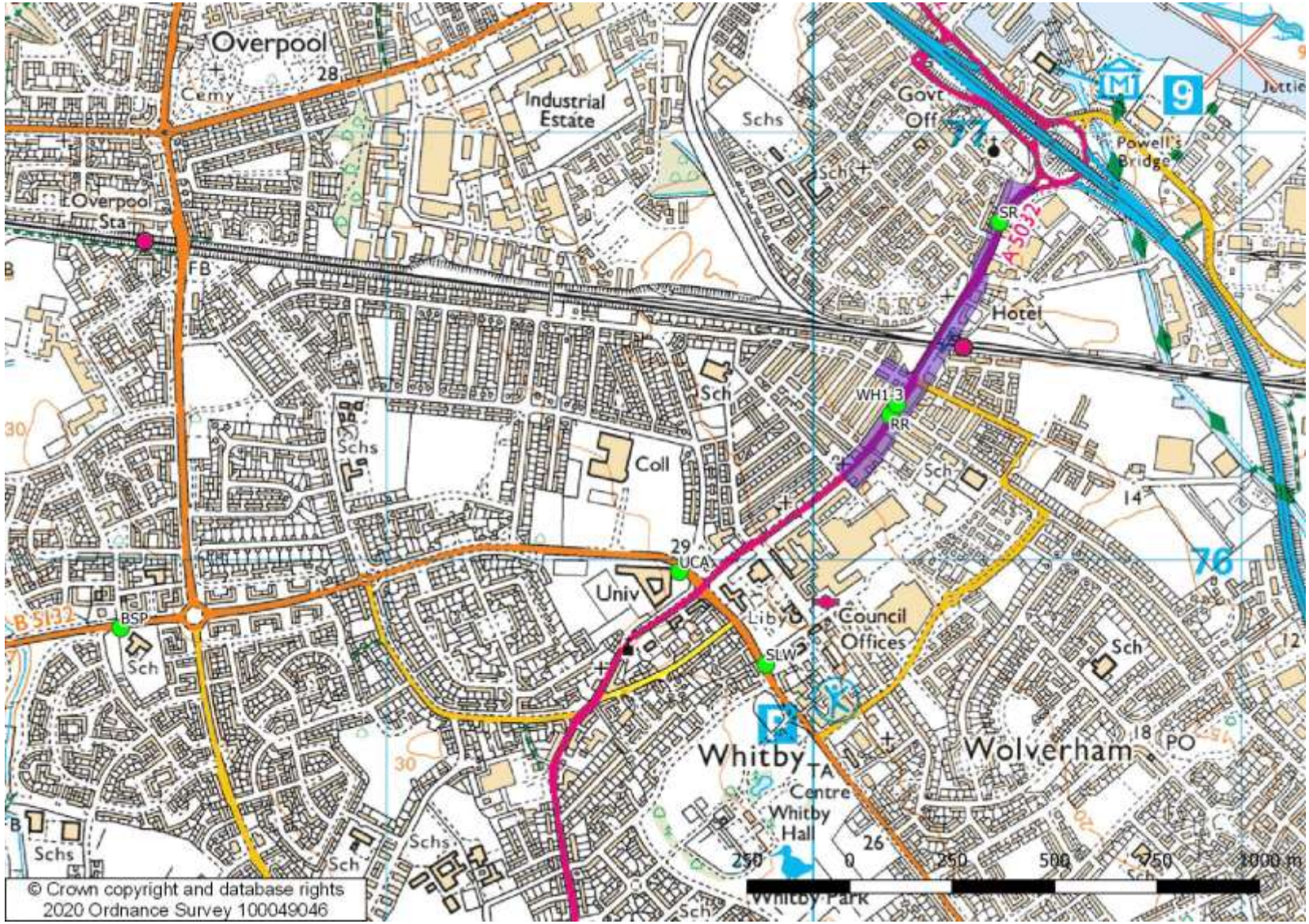


Figure 19 – Map of monitoring sites and AQMA, Frodsham

Figure 20 – Map of monitoring sites and AQMA, Thornton-le-Moors / Elton

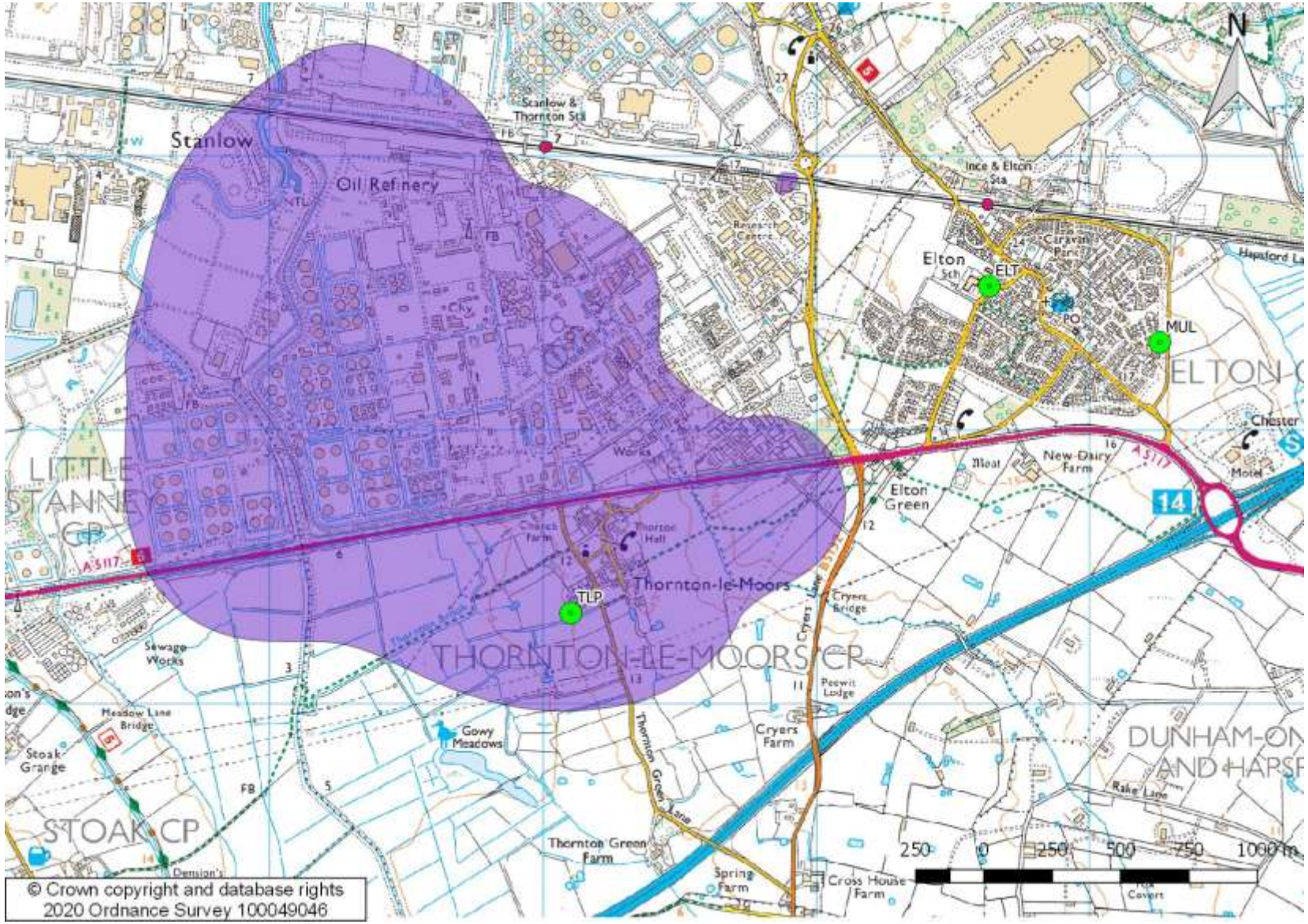


Figure 21 – Map of monitoring sites, Upton

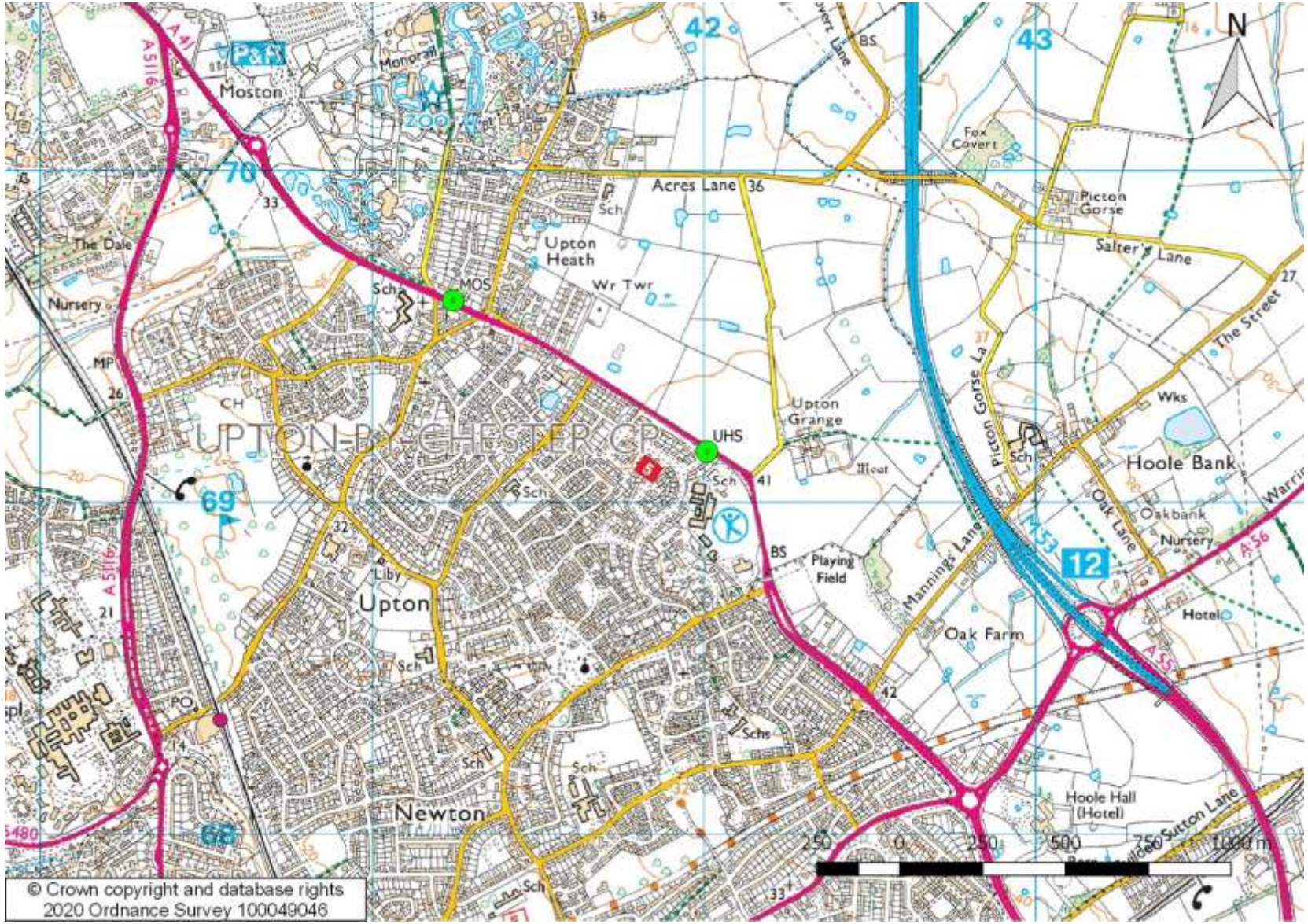


Figure 22 – Map of monitoring sites, Christleton / Littleton / Boughton Heath

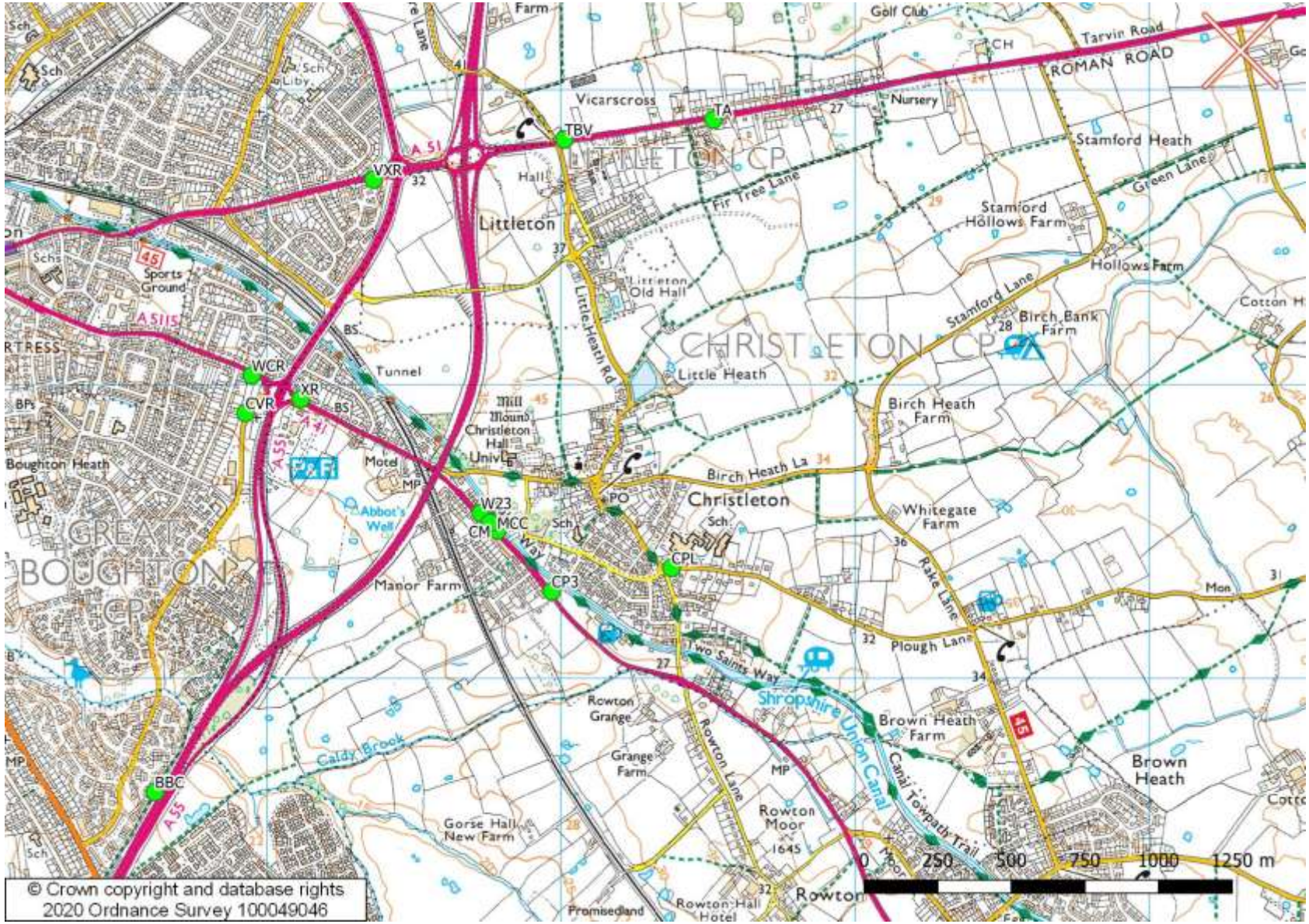


Figure 23 – Map of monitoring sites, Tarvin / Duddon

Figure 24 – Map of monitoring site, Neston

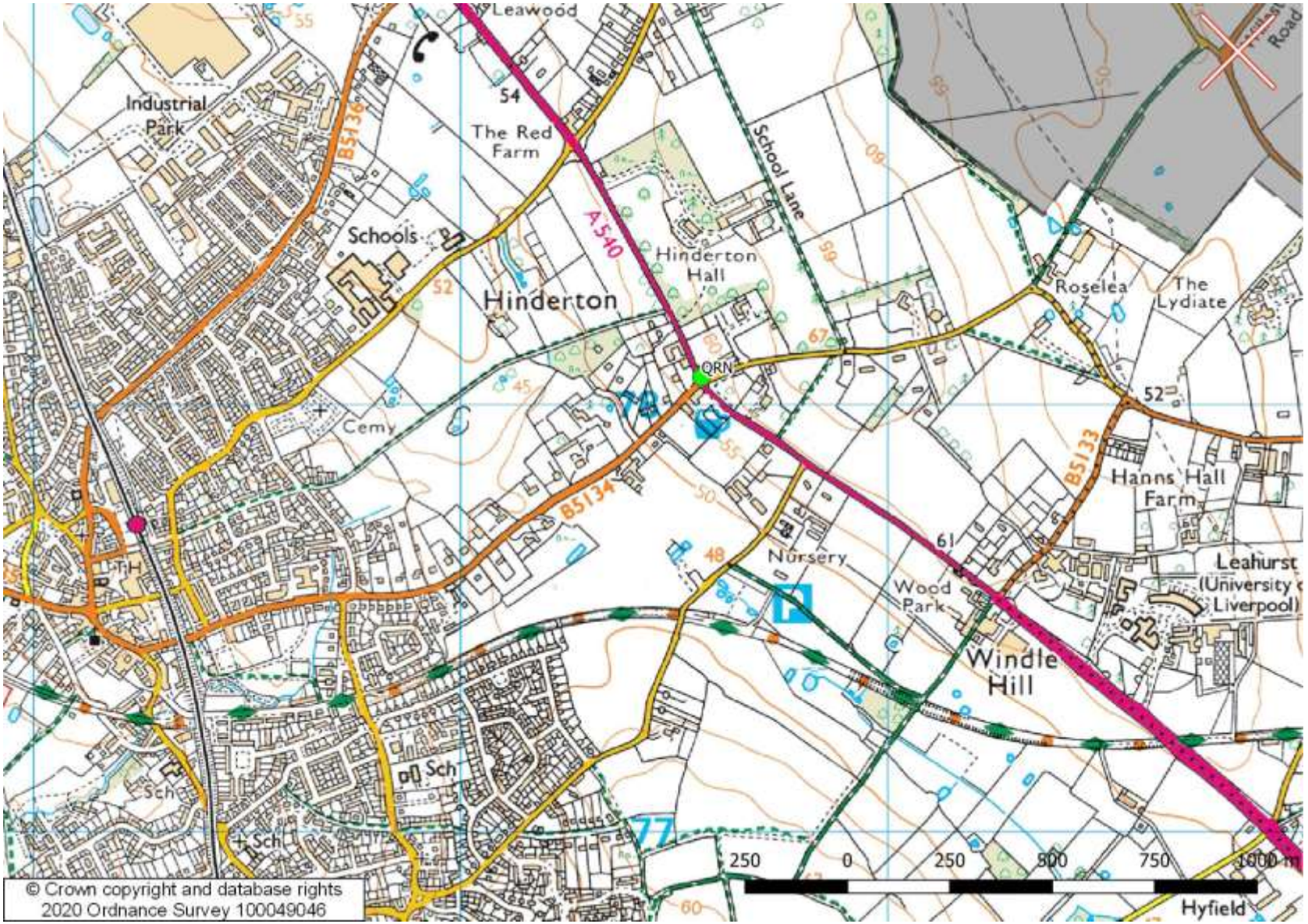


Figure 25 – Map of monitoring site, Helsby

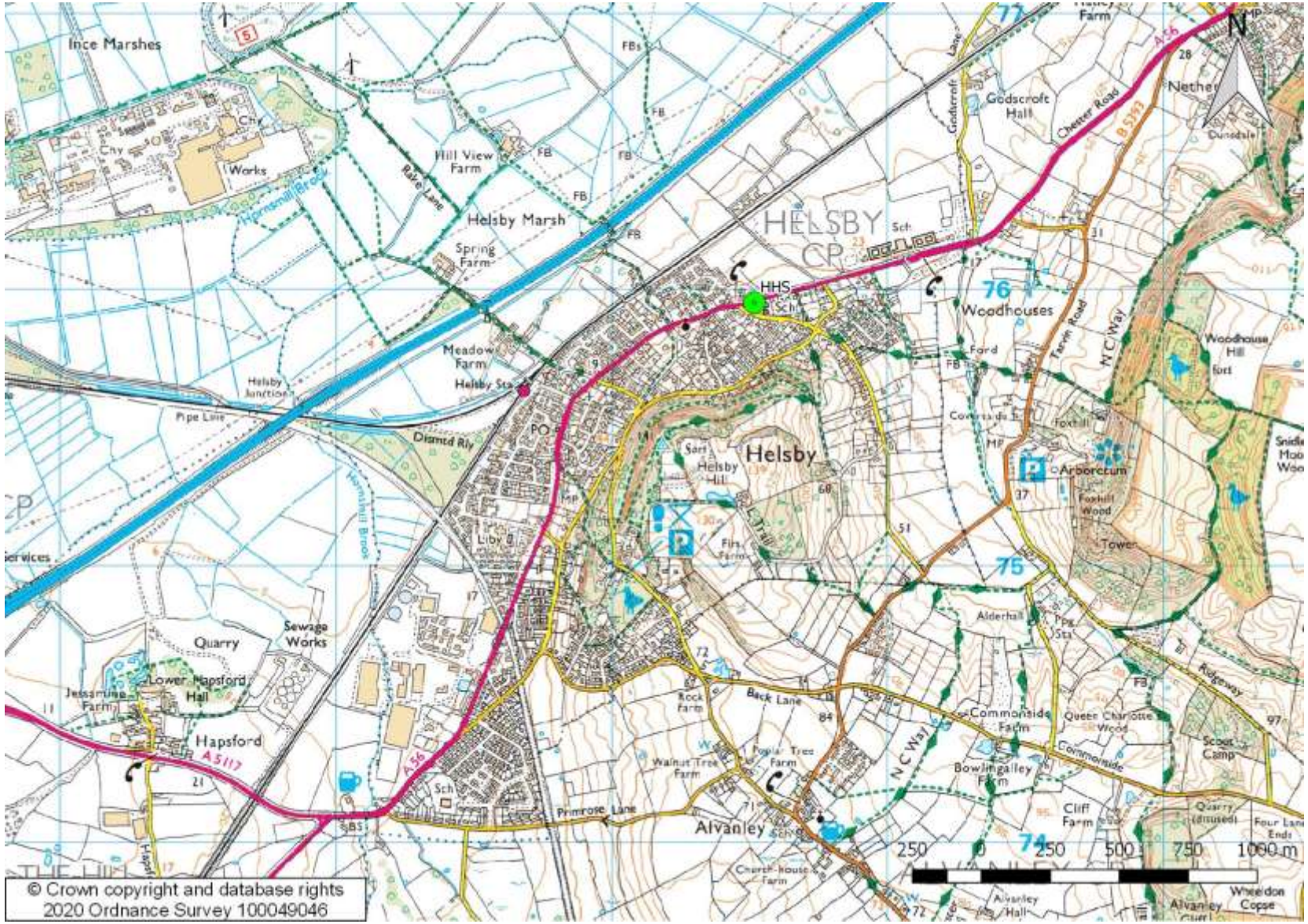


Figure 26 – Map of monitoring site, Delamere

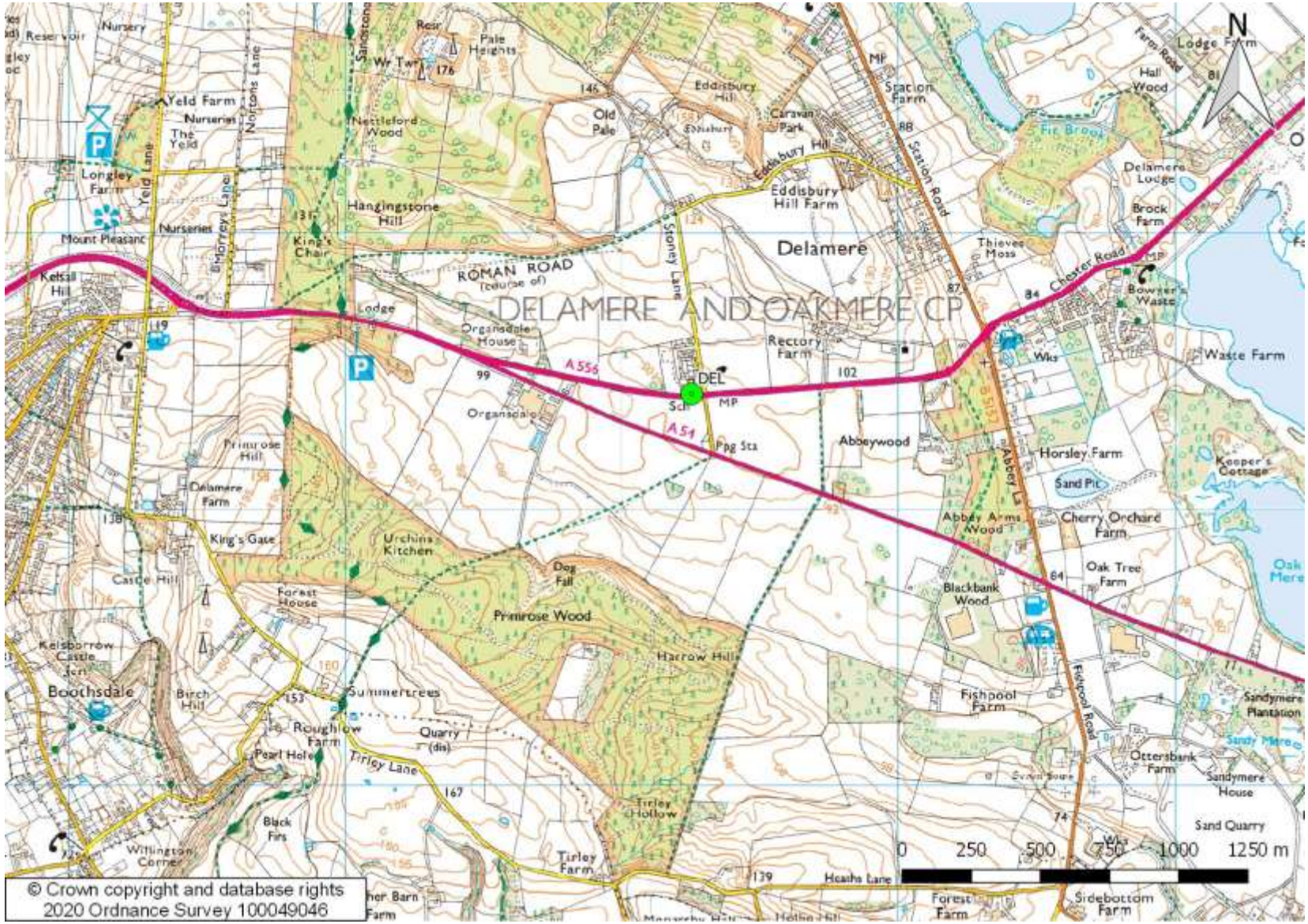


Figure 27 – Map of monitoring sites, Northwich

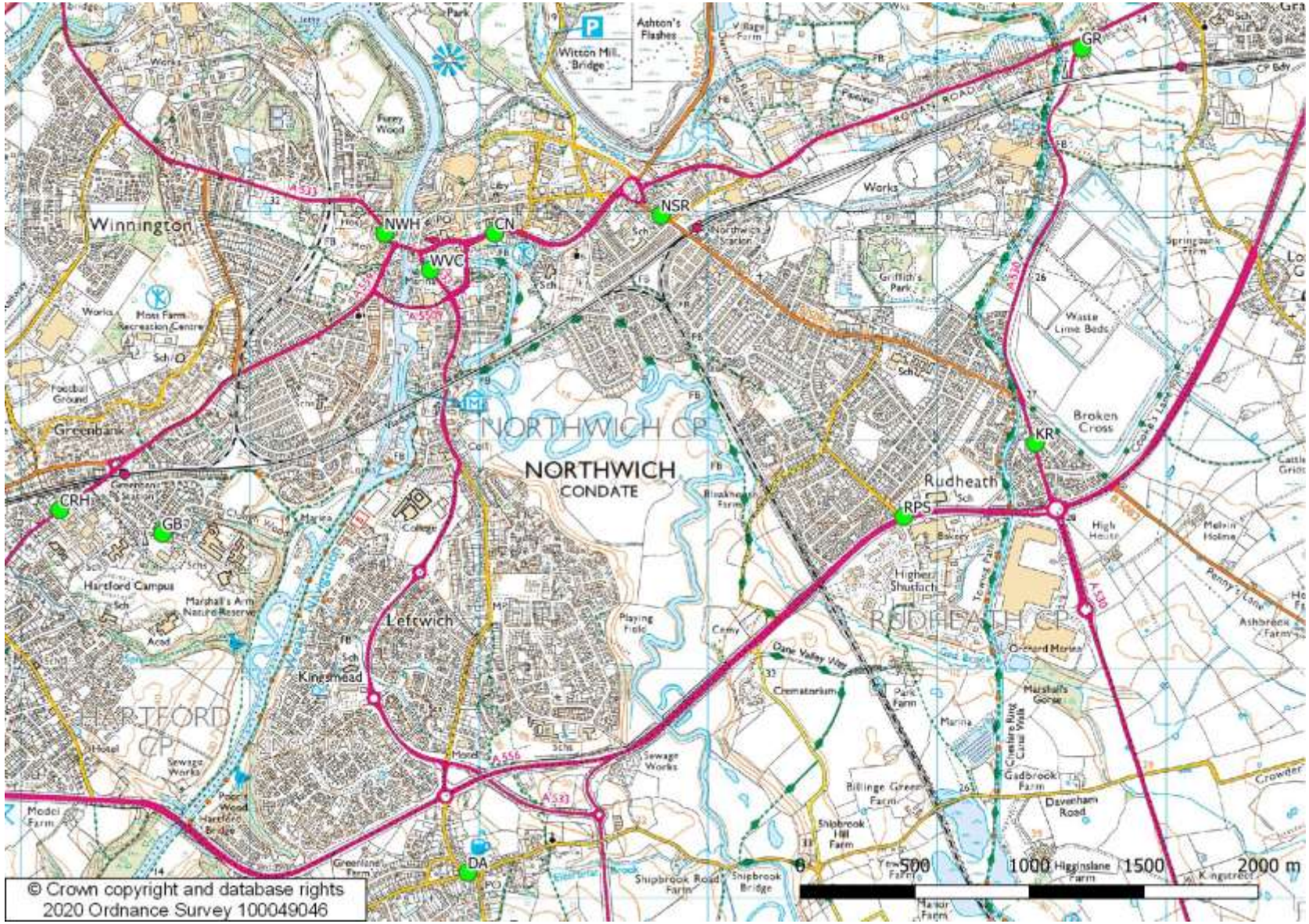


Figure 28 – Map of monitoring sites, Winsford

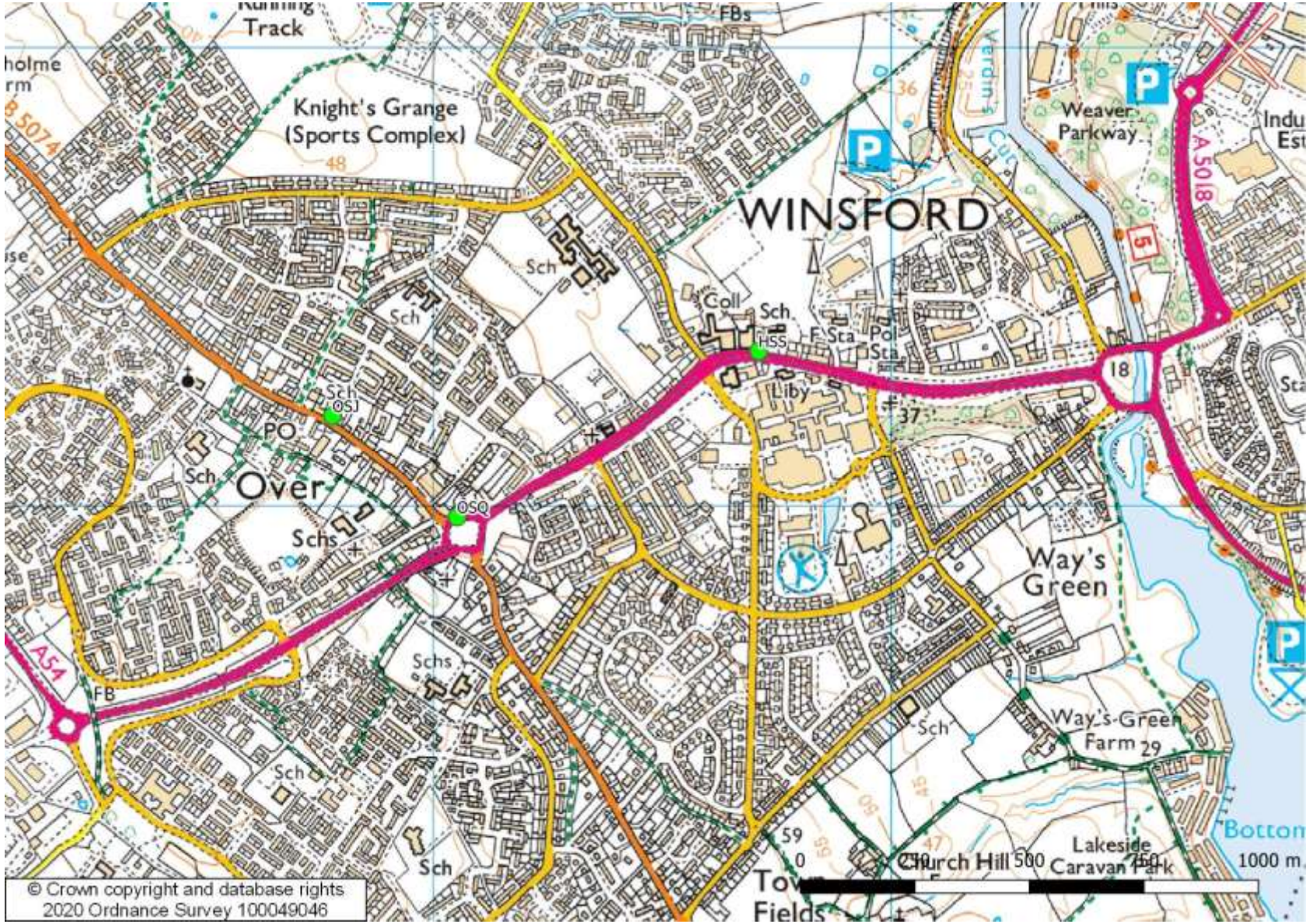


Figure 29 – Map of monitoring sites, Allostock

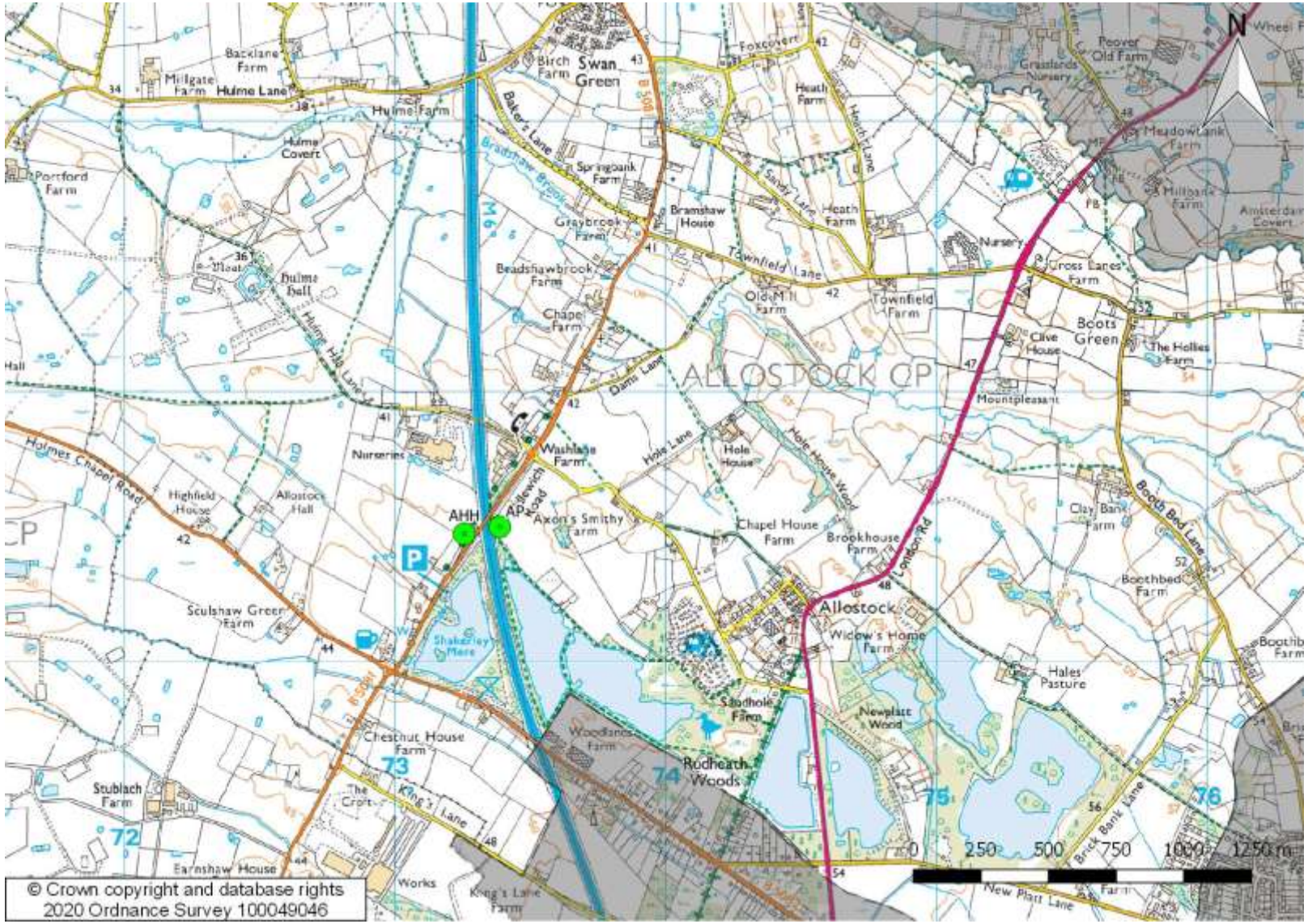


Figure 30 – Map of monitoring site, Wimboldsley

Appendix E: Summary of air quality objectives in England

Table 23 – 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 micrograms of pollutant per cubic metre of air (µg/m^3).

Appendix F: Impact of COVID-19 upon LAQM

COVID-19 has had a significant impact on society. Inevitably, COVID-19 has also had an impact on the environment, with implications to air quality at local, regional and national scales.

COVID-19 has presented various challenges for Local Authorities with respect to undertaking their statutory LAQM duties in the 2021 reporting year. Recognising this, Defra provided various advice updates throughout 2020 to English authorities, particularly concerning the potential disruption to air quality monitoring programmes, implementation of Air Quality Action Plans (AQAPs) and LAQM statutory reporting requirements. Defra has also issued supplementary guidance for LAQM reporting in 2021 to assist local authorities in preparing their 2021 ASR. Where applicable, this advice has been followed.

Despite the challenges that the pandemic has given rise to, the events of 2020 have also provided Local Authorities with an opportunity to quantify the air quality impacts associated with wide-scale and extreme intervention, most notably in relation to emissions of air pollutants arising from road traffic. The vast majority (>95%) of AQMAs declared within the UK are related to road traffic emissions, where attainment of the annual mean objective for nitrogen dioxide (NO_2) is considered unlikely. On 23rd March 2020, the UK Government released official guidance advising all members of public to stay at home, with work-related travel only permitted when absolutely necessary. During this initial national lockdown (and to a lesser extent other national and regional lockdowns that followed), marked reductions in vehicle traffic were observed; Department for Transport (DfT) data[8] suggests reductions in vehicle traffic of up to 70% were experienced across the UK by mid-April, relative to pre COVID-19 levels.

This reduction in travel in turn gave rise to a change of air pollutant emissions associated with road traffic, i.e. oxides of nitrogen (NO_x), and exhaust and non-exhaust particulates (PM). The Air Quality Expert Group (AQEG)[9] has estimated that during the initial lockdown period in 2020, within urbanised areas of the UK reductions in NO_2 annual mean concentrations were between 20 and 30% relative to pre-pandemic levels, which

[8] Prime Minister's Office, COVID-19 briefing on the 31st of May 2020

[9] Air Quality Expert Group, Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19 outbreak in the UK, June 2020

represents an absolute reduction of between 10 to 20µg/m^3 if expressed relative to annual mean averages. During this period, changes in $PM_{2.5}$ concentrations were less marked than those of NO_2. $PM_{2.5}$ concentrations are affected by both local sources and the transport of pollution from wider regions, often from well beyond the UK. Through analysis of AURN monitoring data for 2018-2020, AQEG have detailed that $PM_{2.5}$ concentrations during the initial lockdown period are of the order 2 to 5µg/m^3 lower relative to those that would be expected under business-as-usual conditions.

As restrictions are gradually lifted, the challenge is to understand how these air quality improvements can benefit the long-term health of the population.

Impacts of COVID-19 on air quality within Cheshire West and Chester

Basic comparisons of automatic roadside data suggest that there was a 23 to 26% reduction in annual mean NO_2 concentrations in 2020 relative to 2019. All monitoring sites within the Chester AQMA were compliant with the annual mean objective in 2020. However, caution needs to be used before drawing conclusions from this comparison because prevailing weather conditions have such a significant influence on ambient concentrations. Taking expected year-on-year reductions into account, NO_2 reductions of between 27 and 48% were experienced at Chester's roadside automatic monitoring sites between the end of March and April 2020 as compared to the equivalent period in 2019 (see Figure 31). The highest reductions were observed at CBI monitoring station, adjacent to the bus interchange. Annual average daily flow data on the Department for Transport's Road Traffic Statistics website (https://roadtraffic.dft.gov.uk/) suggest that traffic counts for Chester in 2020 were typically about 25% down on the previous year.

Opportunities presented by COVID-19 upon LAQM within Cheshire West and Chester

- In Chester in 2020, tranche one of the DfT Emergency Active Travel Fund (EATF) was utilised to introduce a cycle lane trial. 'Pop-up' cycle lanes were created on Northgate Street and Wrexham Road/Grosvenor Bridge in a trial running for 12-18 months.

- The EATF was also used to trial active travel lanes (mixed use bus and cycle corridors) along the A51 through Boughton The Bars and on Liverpool Road between Bache and Mollington. This ran for 6 months but has now been paused, pending assessment of their effectiveness.
- Also in Chester, a DfT approved commercially funded e-scooter rental trial was introduced in December 2020. Of the 450 scooters permitted under the scheme, 160 have been deployed at various hubs around the city. The scheme is currently envisaged to operate on a trial basis until March 2022.

Challenges and constraints imposed by COVID-19 upon LAQM within Cheshire West and Chester

Below are details on challenges and/or constraints that have been experienced in relation to LAQM within 2020 that can be attributed to the pandemic. For each challenge and/or constraint an impact rating has been given in line with guidance presented within the LAQM Impact Matrix provided in Table 24.

- During 2020, access to a number of diffusion tube monitoring sites was restricted due to their locations on residential buildings, and temporary closure of the analytical laboratory led to samples either being exposed past their recommended exposure period or not being analysed within their use-by dates. Therefore, it was not possible to maintain diffusion tube exposure periods for February to April in line with the national monitoring calendar for any of our sites. This has affected data capture within 2020, resulting in monitoring sites having to be annualised. **Medium Impact**
- The 2020 Annual Status Report was not completed or submitted to Defra for appraisal. With the agreement of Defra it was decided to combine the 2020 and 2021 ASRs into a single (this) report. **Medium Impact**
- The Chester city centre AQAP is being finalised. However, owing to staff shortages and the reallocation of Council resources during 2020, the development and implementation of the AQAP has been delayed. Current estimates are that the revised AQAP will be submitted to Defra in September and published in October 2021. **Small Impact**
- Delivery of measure number 5 in the Chester city centre AQAP (draft) was delayed during the 2020 lockdown. Funding for 75% of the costs of installation of 12 double-

socket fast EV chargepoints had been secured through the OLEV on-street residential chargepoint scheme. Access and staffing constraints during lockdown led to the network's launch being pushed back to May 2021. However, all sites are now live and operational. **Medium Impact**

The impacts as presented above are aligned with the criteria as defined in Table 24, with professional judgement considered as part of their application.

Figure 31 – Percentage change in monitored oxides of nitrogen 2019 – 2020

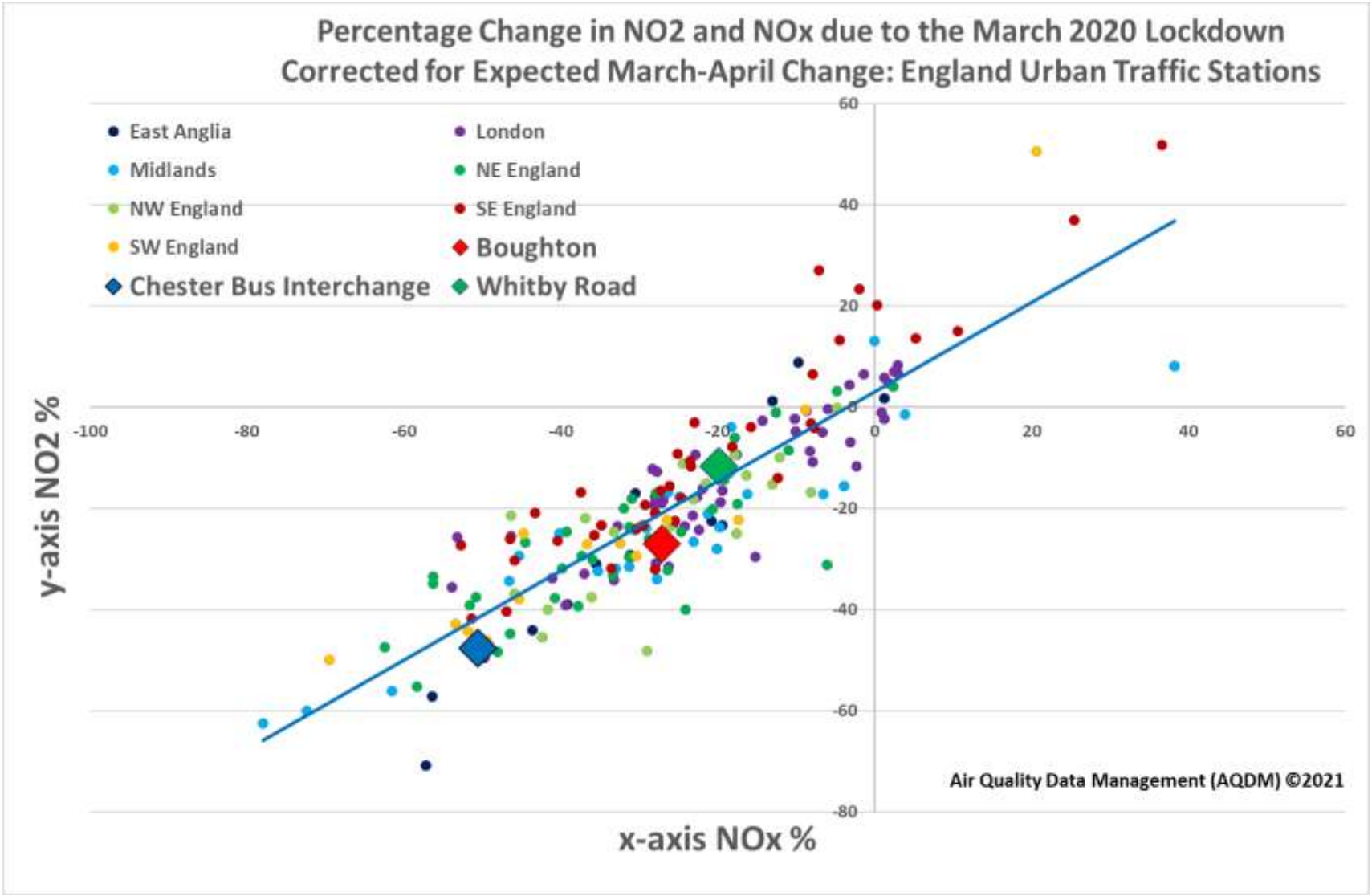


Table 24 – Impact matrix

Category	Impact Rating: None	Impact Rating: Small	Impact Rating: Medium	Impact Rating: High
Automatic Monitoring – Data Capture (%)	More than 75% data capture	50 to 75% data capture	25 to 50% data capture	Less than 25% data capture
Automatic Monitoring – QA/QC Regime	Adherence to requirements as defined in LAQM.TG16	Routine calibrations taken place frequently but not to normal regime. Audits undertaken alongside service and maintenance programmes	Routine calibrations taken place infrequently and service and maintenance regimes adhered to. No audit achieved	Routine calibrations not undertaken within extended period (e.g. 3 to 4 months). Interruption to service and maintenance regime and no audit achieved
Passive Monitoring – Data Capture (%)	More than 75% data capture	50 to 75% data capture	25 to 50% data capture	Less than 25% data capture
Passive Monitoring – Bias Adjustment Factor	Bias adjustment undertaken as normal	<25% impact on normal number of available bias adjustment colocation studies (2020 vs 2019)	25-50% impact on normal number of available bias adjustment studies (2020 vs 2019)	>50% impact on normal number of available bias adjustment studies (2020 vs 2019) and/or applied bias adjustment factor studies not considered representative of local regime
Passive Monitoring – Adherence to Changeover Dates	Defra diffusion tube exposure calendar adhered to	Tubes left out for two exposure periods	Tubes left out for three exposure periods	Tubes left out for more than three exposure periods
Passive Monitoring – Storage of Tubes	Tubes stored in accordance with laboratory guidance and analysed promptly.	Tubes stored for longer than normal but adhering to laboratory guidance	Tubes unable to be stored according to be laboratory guidance but analysed prior to expiry date	Tubes stored for so long that they were unable to be analysed prior to expiry date. Data unable to be used
AQAP – Measure Implementation	Unaffected	Short delay (<6 months) in development of a new AQAP, but is on-going	Long delay (>6 months) in development of a new AQAP, but is on-going	No progression in development of a new AQAP
AQAP – New AQAP Development	Unaffected	Short delay (<6 months) in development of a new AQAP, but is on-going	Long delay (>6 months) in development of a new AQAP, but is on-going	No progression in development of a new AQAP

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
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges – Air quality screening tool produced by Highways England
EU	European Union
FDMS	Filter Dynamics Measurement System
LAQM	Local Air Quality Management
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
OLEV	Office for Low Emission Vehicles (now OZEV – Office for Zero Emission Vehicles)
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.TG16. April 2021. 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.PG16. May 2016. Published by Defra in partnership with the Scottish Government, Welsh Assembly Government and Department of the Environment Northern Ireland.