2022 Air Quality Annual Status Report (ASR)

In fulfilment of Part IV of the Environment Act 1995

Local Air Quality Management

May, 2022

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Executive Summary: Air Quality in Our Area

The 2022 Annual Status Report is designed to provide the public with information relating to local air quality in Chelmsford, to fulfil Chelmsford City Council's statutory duty to review and assess air quality within its area, and to determine whether or not the air quality objectives are likely to be achieved.

Due to the Covid-19 pandemic, traffic levels were significantly lower than average in 2020 and 2021. Consequently, air quality improved and it is important to acknowledge that data from these years will differ significantly from historical trends.

In 2021, Chelmsford City Council did **not** measure an exceedance of the Air Quality Objectives at relevant exposure.

Air Quality in Chelmsford

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].

Chelmsford is located in mid Essex, thirty-one miles from London and has a population of over 181,500 (2021 census), largely living in the main urban areas of Chelmsford and South Woodham Ferrers. The City of Chelmsford comprises of a number of suburban areas surrounding the main urban areas and the larger rural villages of Danbury, East and West Hanningfield, Great Leighs, Little Waltham and Little Baddow.

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 2021
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

Chelmsford City Council has declared two Air Quality Management Areas (AQMA) due to emissions from road traffic causing exceedances of the nitrogen dioxide annual mean air quality objective.

These AQMAs are detailed in Table 2.1 and further information online at https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=53

Chelmsford City Council has been working with Essex County Council and Essex Highways to monitor traffic movements within AQMAs and across the transport network. Traffic levels have returned to normal and at some locations even exceeded 2019 levels. However, traffic patterns have changed with a reduction of rush hour traffic, less slow moving vehicles and congestion occurring. This is due to a steadier flow of traffic moving across the day.

There is a steady trend of improvement in air quality. Measured air quality is better at many monitoring sites than in 2020 despite traffic levels returning to normal.

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

The future of the Army & Navy junction has been determined with a 'hamburger' junction proposed and Chelmsford. An outline business case for the revised £67million Army and Navy Sustainable Transport Package will be submitted to the Department for Transport this summer, with a planning application expected in early 2023 and construction scheduled to start in winter 2024.

[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

The proposed expansion of Chelmer Valley and Sandon Park and Ride services will increase overall Park and Ride spaces in Chelmsford and reduce traffic heading into the city centre and using the Army and Navy junction.

Essex County Council submitted a bid for the 2022 air quality grant. The bid contained proposals for providing an education and awareness theatre production within schools alongside air quality monitoring in schools. The proposals also contained updates to the existing Essex Air website.

Conclusions and Priorities

Chelmsford City Council have concluded that:

- Chelmsford City Council measured no exceedances of the air quality objectives
- All monitoring results within the Army and Navy AQMA are below the air quality objective, however it is not considered appropriate to revoke the AQMA yet as monitored levels are still borderline with the air quality objectives
- The 2021 ASR concluded that further traffic and air quality monitoring would be required within the Danbury AQMA. Traffic levels are considered to have returned to normal following the Covid-19 pandemic however the monitored levels are over 12.5% lower than the air quality objectives.
- All pollutants measured by automatic analyser are trending downwards
- Diffusion tube monitoring results are trending downwards
- Air quality in Chelmsford is considered to be improving
- There any no new developments that have been considered to have a significant impact on local air quality

For 2022, Chelmsford City Council have a number of priorities:

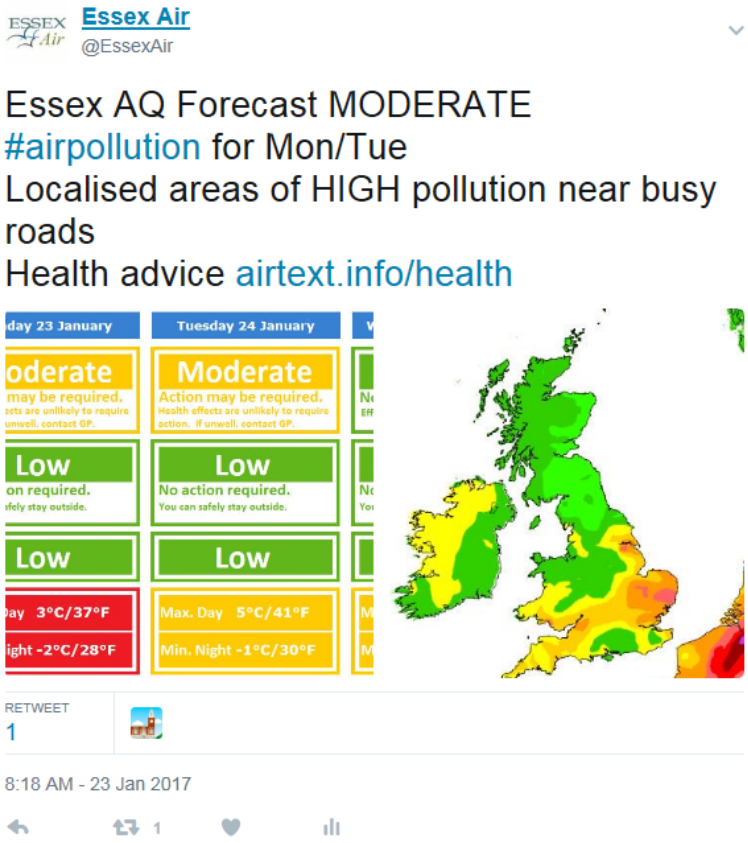
- Adopt the Chelmsford City Council Air Quality Strategy and accompanying Air Quality Monitoring Plan
- Publish a public facing air quality webpages on the Love Your Chelmsford that will contain live monitoring data, air quality forecasts and educational material.
- Undertake air quality assessment of the newly proposed Army & Navy Junction
- Develop a project plan for the rollout of air quality and traffic sensor nodes across Chelmsford

Local Engagement and How to get Involved

Pollution Forecasts and Alerts

Chelmsford City Council is a member of the Essex Air Quality consortium. The Essex Air web site provides a daily forecast of air pollution which is based off UK-AIR data feeds. Also, the @EssexAir twitter feed provides localised weekly air pollution forecasts.

Figure i.1 - Essex Air Twitter Air Quality Notifications



Links to Defra recommended actions and health advice are provided when air pollution is likely to be moderate or higher. This will enable those with heart or lung conditions, or other breathing problems to make informed judgements about their levels of activity or exposure.

Local Responsibilities and Commitment

This ASR was prepared by Public Health and Protection Services of Chelmsford City Council.

This ASR has been approved by:

Paul Brookes – Public Health and Protection Services Manager, Chelmsford City Council

This ASR has been sent to the Director of Public Health at Essex County Council.

If you have any comments on this ASR please send them to Tim Savage at:

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1 Local Air Quality Management

This report provides an overview of air quality in Chelmsford during 2021. 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 Chelmsford to improve air quality and any progress that has been made.

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

2 Actions to Improve Air Quality

2.1 Air Quality Management Areas

Air Quality Management Areas (AQMAs) are declared when there is an exceedance or likely exceedance of an air quality objective. After declaration, the authority 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 Chelmsford City Council can be found in Table 2.1 below. The table presents a description of the two AQMAs that are currently designated within Chelmsford. Appendix D: Maps of Monitoring Locations and AQMAs provides maps of AQMAs and also the air quality monitoring locations in relation to the AQMAs. Further information on the AQMAs can be found on the UK-AIR website https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=53

The AQMAs are designated due to exceedances of the nitrogen dioxide (NO_2) air quality objectives. A summary of the air quality objectives can be found in Appendix E.

Table 2.1 – 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
Army & Navy AQMA	Declared 01/12/2005Amended 1/10/2012	NO_2 Annual Mean	Army & Navy Roundabout and surrounding roads	No	**51.0µg/m^3**	No Exceedance	Air Quality Action Plan: Army & Navy July 2008	https://uk-air.defra.gov.uk/assets/documents/no2ten/Local_zone29_Chelmsford_AQActionplan_1.pdf
A414 Maldon Road, Danbury	Declared 08/10/2018	NO_2 Annual Mean	The stretch of road between Gay Bowers Lane and Danbury Village Green	No	**47.3µg/m^3**	No Exceedance	In Development	N/A

☒ **Chelmsford City Council confirm the information on UK-Air regarding their AQMA(s) is up to date**

2.2 Progress and Impact of Measures to address Air Quality in Chelmsford

Chelmsford City Council and Essex County Council have taken forward a number of direct measures during the current reporting year of 2021 in pursuit of improving local air quality. Details of all measures completed, in progress or planned are set out in Table 2.. 11 measures are included within Table 2., with the type of measure and the progress Chelmsford City Council and Essex County Council have made during the reporting year of 2021 presented. Where there have been, or continue to be, barriers restricting the implementation of the measure, these are also presented within Table 2..

Table 2.2 – 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	Chelmsford Growth Package - Outer Zone	Transport Planning and Infrastructure	Other	2010-2017	2022	Essex County Council	Essex County Council / South East Local Enterprise Partnership	NO	Funded	£1 million - £10 million	Implementation				Bus Priority Measures. Focus on removing as much traffic as possible on the outskirts of the City by emphasising existing rail and Park & Ride routes and exploring potential for future services.
2	Chelmsford Growth Package - Mid Zone	Transport Planning and Infrastructure	Other	2017	2022	Essex County Council	Essex County Council / South East Local Enterprise Partnership	NO	Funded	£1 million - £10 million	Completed				Sustainable alternatives to the private car use and encouraging trips using public transport, cycling and on the pedestrian network
3	Chelmsford Growth Package - Inner Zone	Promoting Travel Alternatives	Promotion of walking	2017	2022	Essex County Council	Essex County Council / South East Local Enterprise Partnership	NO	Funded	£1 million - £10 million	Completed				Public Realm Improvements - Improving the quality of the walking environment
4	Army & Navy Sustainable Transport Package	Transport Planning and Infrastructure	Other	2019	2025	Essex County Council		NO	Not Funded	> £10 million	Planning			A new 'hamburger' junction has been formally approved	Funding proposal to be submitted to DfT
5	Chelmsford Air Quality Strategy	Policy Guidance and Development Control	Low Emissions Strategy	2018	2022	Chelmsford City Council	Chelmsford City Council	NO	Funded	< £10k	Planning			Strategy is due to be adopted in 2022	

6	Essex Liftshare	Alternatives to private vehicle use	Car & lift sharing schemes	N/A	N/A	Essex County Council	Essex County Council	NO	Funded	< £10k	Implementation				
7	Member of Essex Air	Policy Guidance and Development Control	Regional Groups Co-ordinating programmes to develop Area wide Strategies to reduce emissions and improve air quality	N/A	N/A	Chelmsford City Council / Essex Air	N/A	NO	Funded	< £10k	Implementation				
8	Environmental Permit Inspection & Enforcement	Environmental Permits	Measures to reduce pollution through IPPC Permits going beyond BAT	N/A	N/A	Chelmsford City Council	Chelmsford City Council	NO	Funded	< £10k	Implementation				
9	Replace all Council fleet vehicles that do not currently meet the Euro 6/VI emissions standard	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2020	2024	Chelmsford City Council	Chelmsford City Council	NO	Funded	£1 million - £10 million	Planning			Replacement programme in place [fully funded] to ensure that all vehicles in the Council fleet will meet at least the low-emission standard by 2024	
10	Evaluate ultra-low emission alternatives [electric or hydrogen powered] for selected vehicles where operationally and commercially viable	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2020	2021	Chelmsford City Council	Chelmsford City Council	NO	Funded	£10k - 50k	Complete			Two further electric-powered [ultra-low emission] utility vehicles due for delivery to Parks in January 2020. Two tipper mini-vans used by grounds maintenance team to be replaced with electric-powered alternative in 2020/21	
11	Acquire a selection of low emission or ultra-low emission 'pool' vehicles to provide more sustainable options for business travel	Promoting Low Emission Transport	Company Vehicle Procurement - Prioritising uptake of low emission vehicles	2020	2022	Chelmsford City Council	Chelmsford City Council	NO	Not Funded	£100k - £500k	Planning			Capital programme bid submitted to acquire up to 5 pool vehicles	Delays incurred due to a shortage of appropriate vehicles

2.3 PM2.5 – 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.

Chelmsford City Council commenced $PM_{2.5}$ monitoring in 2019 at the Springfield Road (Chelmsford Prison) site which routinely measures the highest PM_{10} in the monitoring network. This location is sited next to a busy road and junction along with an adjacent bus stop. The $PM_{2.5}$ annual mean measurement for 2021 was 10.9µg/m^3.

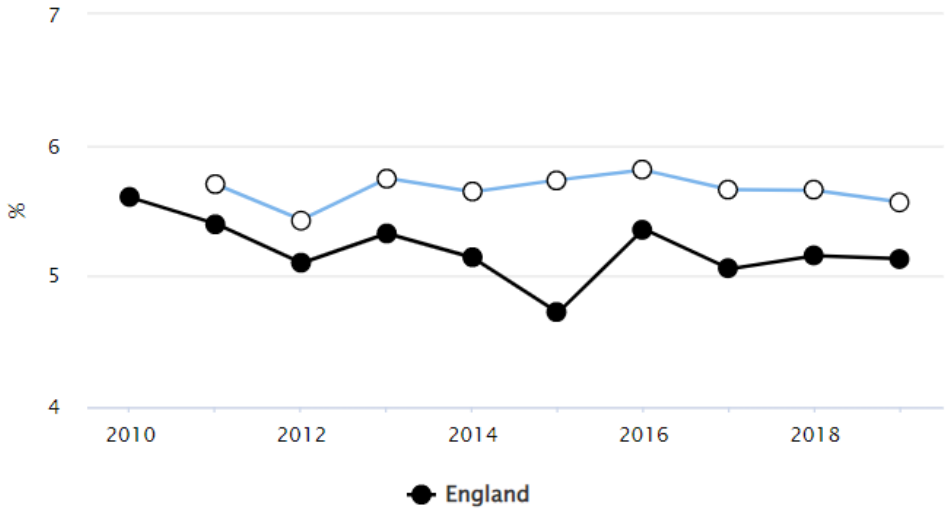
Table 2.3 – Measured $PM_{2.5}$ Concentrations

Monitoring Site	$PM_{2.5}$ Annual Mean Concentration		
	2019	2020	2021
CM2 Springfield Road	11.4µg/m³	10.2µg/m³	10.9µg/m³

There is a strong correlation between $PM_{2.5}$ and PM_{10} concentrations. PM_{10} monitoring results shown in Appendix A identify long term downward trends. This suggests that $PM_{2.5}$ concentrations may also be reducing across Chelmsford.

The Public Health Outcomes Framework indicator D01 – Fraction of mortality attributable to particulate ($PM_{2.5}$) air pollution which for 2019 gave a value of 5.6% which has improved from 5.7% in 2011. These values are broadly similar to other authorities within the region.

Figure 2.1 – Public Health Framework Indicator D01 Fraction of all-cause adult mortality attributable to anthropogenic particulate air pollution



Chelmsford City Council is taking the following measures to address $PM_{2.5}$:

- Use of Essex Air twitter to encourage the reporting of smoky vehicles through the DVSA reporting service. It is possible to report either heavy goods vehicles or public service vehicles (buses).
- Regular inspections of permitted industry where combustion and non-combustion processes could lead to anthropogenic emissions of $PM_{2.5}$

Defra is undertaking development of the new environmental targets under the Environment Act 2021. Following public consultation, legislation will be put before parliament by 31st October 2022 and may make requirement on Local Authorities to undertake actions to reduce $PM_{2.5}$ which is linked to a public health benefit.

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

This section sets out the monitoring undertaken within 2021 by Chelmsford City Council and how it compares with the relevant air quality objectives. In addition, monitoring results are presented for a five-year period between 2017 and 2021 to allow monitoring trends to be identified and discussed.

Quality assurance and quality control information for the automatic analysers, diffusion tubes bias adjustments and other adjustments applied (e.g. annualisation and/or distance correction) are presented in Appendix C. Maps showing the location of the monitoring sites are presented in Appendix D.

3.1 Summary of Monitoring Undertaken

3.1.1 Automatic Monitoring Sites

Chelmsford City Council undertook automatic (continuous) monitoring at four sites during 2020 measuring Nitrogen Dioxide (NO_2). In addition, three of these sites measure Particulate Matter (PM_{10}), one site measures Particulate Matter ($PM_{2.5}$) and one site measures Ozone (O_3). Table A.1 in Appendix A provides detail of these sites.

Details on how the monitors are calibrated and how the data has been adjusted is provided in Appendix C.

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

3.1.2 Non-Automatic Monitoring Sites

Chelmsford City Council undertook non-automatic (i.e. passive) monitoring of NO_2 using 77 diffusion tubes at 47 sites during 2021. Table A.2 in Appendix A presents the details of the non-automatic sites.

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.

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

3.2 Individual Pollutants

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

3.2.1 Nitrogen Dioxide (NO_2)

In 2021, Chelmsford City Council measured no NO_2 annual mean air quality concentrations in excess of 40µg/m^3.

The maximum annual mean concentrations that were measured were significantly below 60µg/m^3. As such it is very unlikely that an exceedance of the 1-hour mean objective has occurred at any of the monitoring sites.

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

For diffusion tubes, the full 2021 dataset of monthly mean values is provided in Appendix B. Note that the concentration data presented in Table B.1 includes distance corrected values, only where relevant.

Table A.5 in Appendix A compares the ratified continuous monitored NO_2 hourly mean concentrations for the past five years with the air quality objective of 200µg/m3, not to be exceeded more than 18 times per year.

3.2.2 Particulate Matter (PM_{10})

In 2021, Chelmsford City Council measured no exceedances of the PM_{10} annual mean or PM_{10} daily mean air quality objectives.

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

Table A.7 in Appendix A compares the ratified continuous monitored PM_{10} daily mean concentrations for the past five years with the air quality objective of 50µg/m^3, not to be exceeded more than 35 times per year.
There any no proposed changes to the monitoring network?

3.2.3 Particulate Matter ($PM_{2.5}$)

Chelmsford City Council has been monitoring PM2.5 since 2019. The analyser is sited at the CM2 Springfield Road air quality monitoring station.

Figure A.4 presents $PM_{2.5}$ automatic monitoring data from 2019 to 2021. The short-term trend for monitored concentrations is downwards identifying improved air quality.

Table A.8 in Appendix A presents the ratified and adjusted monitored $PM_{2.5}$ annual mean concentrations from 2019 to 2021

3.2.4 Ozone (O3)

It is not a requirement of Local Air Quality Management to monitor Ozone concentrations. However, Chelmsford City Council undertakes measurement at the Chignal St James rural background monitoring site.

Table A.9 in Appendix A provides the results of ozone monitoring from 2011 to 2021.

Figure A.5 presents this data graphically.

Appendix A: Monitoring Results

Table A.1 – Details of Automatic Monitoring Sites

Site ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Monitoring Technique	Distance to Relevant Exposure (m) (1)	Distance to kerb of nearest road (m) (2)	Inlet Height (m)
CM1	Chignal St James	Rural	566463	210830	NO, NOx, NO2, PM10, O3	NO	Chemiluminescent / Unheated BAM / UV Photometry	40	43	4
CM2	Springfield Road (Prison)	Roadside	571640	207179	NO, NOx, NO2, PM10, PM2.5	NO	Chemiluminescent / Unheated BAM / Heated BAM	29.2	2.8	2.5
CM3	Rainsford Lane (Fire Station)	Roadside	569912	206881	NO, NOx, NO2, PM10	NO	Chemiluminescent / Unheated BAM	20	2.5	2.5
CM4	Baddow Road	Roadside	571654	205798	NO, NOx, NO2	NO	Chemiluminescent	12	5.1	1.5

Notes:

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

(2) N/A if not applicable

Table A.2 – Details of Non-Automatic Monitoring Sites

Diffusion Tube ID	Site Name	Site Type	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Pollutants Monitored	In AQMA? Which AQMA?	Distance to Relevant Exposure (m)	Distance to Kerb of Nearest Road (m)	Tube Co-located with a Continuous Analyser	Height (m)
CB01	12 Van Diemans Road	Roadside	571421	205963	NO_2	Yes Army & Navy AQMA	0.0	12.0	No	2.5
CB02	3 Moulsham Chase	Roadside	571388	205725	NO_2	No	9.3	2.5	No	2.5
CB13	60 Roxwell Road	Roadside	569077	207528	NO_2	No	0.0	16.0	No	2.5
CB22, CB22B, CB22C	95 Baddow Road	Roadside	571505	205968	NO_2	Yes Army & Navy AQMA	0.0	8.0	No	2.5
CB26, CB26B, CB26C	214 Baddow Road	Roadside	571614	205812	NO_2	No	0.0	5.0	No	2.5
CB27	Howe Green Interchange	Roadside	574080	203469	NO_2	No	0.0	18.0	No	2.5
CB32	2 Abbots Place	Roadside	571581	207144	NO_2	No	0.0	5.0	No	2.5
CB33	Victoria Road	Roadside	570974	207157	NO_2	No	3.0	3.0	No	2.5
CB36	2 Rainsford Lane	Roadside	570104	207247	NO_2	No	2.0	1.0	No	2.5
CB38, CB39, CB40	Prison 3	Roadside	571640	207179	NO_2	No	14.0	3.0	Yes	2.5
CB46	32 Rochford Road	Roadside	571062	206281	NO_2	Yes Army & Navy AQMA	2.0	3.0	No	2.5
CB49	26 Rochford Road	Roadside	571104	206262	NO_2	Yes Army & Navy AQMA	0.0	5.0	No	2.5
CB52	Penpol, Victoria Road	Roadside	571367	207014	NO_2	No	0.0	3.0	No	2.5
CB57	Goldlay House, Parkway	Roadside	571359	206124	NO_2	No	0.0	16.0	No	2.5
CB58	148 Baddow Road	Roadside	571476	205964	NO_2	Yes Army & Navy AQMA	0.0	12.0	No	2.5
CB61	10 Fraser Close	Urban Background	571445	205631	NO_2	No	0.0	7.0	No	2.5
CB62, CB63, CB64	Chignal 3	Rural	566463	210830	NO_2	No	40.0	43.0	Yes	4.0
CB65, CB66, CB67	Fire Station 3	Roadside	569912	206881	NO_2	No	20.0	2.5	Yes	2.5
CB68, CB68B, CB68C	Goldlay Avenue 3	Roadside	571382	206092	NO_2	No	0.0	12.0	No	2.5

CB76, CB76B, CB76C	5/7 Maldon Road, Danbury	Roadside	578506	205122	NO_2	Yes Danbury AQMA	0.0	1.0	No	2.5
CB79	10 Waterhouse Lane	Roadside	569480.455	206009.327	NO_2	No	2.0	1.0	No	2.5
CB82	122 Springfield Road	Roadside	571438	206966	NO_2	No	0.0	4.0	No	2.5
CB83	134/136 Springfield Road	Roadside	571462	206999	NO_2	No	0.0	3.0	No	2.5
CB84, CB85, CB86	Baddow Road AQMS 3	Roadside	571653	205800	NO_2	No	12.0	5.1	Yes	1.0
CB87	Bus Station	Urban Centre	570444	207044	NO_2	No	4.0	3.0	No	2.5
CB89	135 Springfield Road	Kerbside	571426	206979	NO_2	No	2.0	0.5	No	2.5
CB90	144 Springfield Road	Roadside	571480	207019	NO_2	No	2.0	2.0	No	2.5
CB91, CB92, CB93	26 Maldon Road, Danbury	Roadside	578539	205113	NO_2	Yes Danbury AQMA	0.0	1.0	No	2.5
CB94	Copt Hill, Danbury	Roadside	578571	205108	NO_2	Yes Danbury AQMA	-1.4	2.8	No	2.5
CB95	Eves Corner, Danbury	Roadside	578415	205106	NO_2	Yes Danbury AQMA	3.0	2.0	No	2.5
CB96	Heathcote School, Main Road, Danbury	Kerbside	578359	205120	NO_2	No	3.0	0.3	No	2.5
CB98A, CB98B, CB98C	Rear of 66 Baddow Road (Dentists)	Roadside	571148	206324	NO_2	Yes	2.0	3.0	No	2.5
CB99A, CB99B, CB99C	Rear of 74 Baddow Road (Aga Shop)	Roadside	571211	206274	NO_2	Yes	3.4	1.3	No	2.5
CB102	Maldon Road Junction w/ The Avenue, Danbury	Roadside	578954.31	205131.82	NO_2	No	1.0	1.0	No	2.5
CB103A, CB103B, CB103C	Opposite Myra Cottage Maldon Road, Danbury	Roadside	578476.76	205110.58	NO_2	Yes Danbury AQMA	8.0	1.0	No	2.5
CB104	Main Road Danbury	Roadside	577583	205360	NO_2	No	2.0	2.0	No	2.5
CB107	Opposite 28 Wood Street	Roadside	569976.94	205233.94	NO_2	No	N/A	1.0	No	2.5
CB108	Blacksmiths Cottage, Maldon Road, Danbury	Urban Background	578487.544	205139.213	NO_2	No	0.0	19.0	No	2.5
CB109	Adjacent to Anytime Fitness, Viaduct Road	Roadside	570456.126	207024.951	NO_2	No	0.0	1.0	No	2.5
CB110A, CB110B, CB110C	Adjacent to 25 Wood Street	Roadside	569982.25	205263.95	NO_2	No	0.0	1.0	No	2.5

CB111A, CB111B, CB111C	Wood Street adjacent to Bruce Grove	Roadside	569996.04	205198.82	NO_2	No	0.0	1.0	No	2.5
CB112A, CB112B, CB112C	Burnham Road / Greenwood Surgery	Roadside	580275	198121	NO_2	No	10.8	1.0	No	2.5
CB113	Broomfield Road	Roadside	570659	210483	NO_2	No	0.0	1.0	No	2.5
CB114	B1008 Ford End	Roadside	567537	216958	NO_2	No	N/A	1.0	No	2.5
CB115	B1418 Woodham Ferrers	Kerbside	579847	199337	NO_2	No	0.0	1.0	No	2.5
CB116	Beauchamps Close	Urban Background	572683	209617	NO_2	No	0.0	11.4	No	2.5
CB117	White Hart Lane adjacent to Centenary Way	Kerbside	572642	209674	NO_2	No	N/A	1.0	No	2.5

Notes:

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

(2) N/A if not applicable.

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

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
CM1	566463	210830	Rural	92.2	92.2	14.5	12.4	11.9	9.3	8.9
CM2	571640	207179	Roadside	95.8	95.8	28.0	29.2	34.5	31.4	28.2
CM3	569912	206881	Roadside	95.8	95.8	26.9	24.2	19.9	18.8	19.7
CM4	571654	205798	Roadside	96.8	96.8	29.5	27.5	27.0	20.7	20.1

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16**

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

Diffusion Tube ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) [1]	Valid Data Capture 2021 (%) [2]	2017	2018	2019	2020	2021
CB01	571421	205963	Roadside	100.0	100.0	32.5	31.7	30.2	24.4	25.6
CB02	571388	205725	Roadside	91.3	91.3	22.6	20.8	19.7	17.1	16.6
CB13	569077	207528	Roadside	100.0	100.0	20.1	18.3	17.7	14.5	14.7
CB22, CB22B, CB22C	571505	205968	Roadside	100.0	100.0	32.3	33.0	29.6	23.6	26.1
CB26, CB26B, CB26C	571614	205812	Roadside	100.0	100.0	31.2	29.7	28.0	24.8	24.0
CB27	574080	203469	Roadside	100.0	100.0	36.4	32.4	31.8	26.2	26.3
CB32	571581	207144	Roadside	90.0	90.0	33.3	29.0	29.3	25.9	24.8
CB33	570974	207157	Roadside	91.3	91.3	32.0	29.8	29.1	25.3	25.3
CB36	570104	207247	Roadside	100.0	100.0	26.2	28.6	28.4	22.8	21.9
CB38, CB39, CB40	571640	207179	Roadside	100.0	100.0	30.3	29.0	28.0	23.6	22.0
CB46	571062	206281	Roadside	100.0	100.0	28.8	27.7	24.9	19.4	22.0
CB49	571104	206262	Roadside	90.0	90.0	23.1	22.3	24.2	20.1	17.3
CB52	571367	207014	Roadside	100.0	100.0	34.3	31.9	29.9	25.7	23.9
CB57	571359	206124	Roadside	100.0	100.0	30.6	28.2	27.6	24.0	23.1
CB58	571476	205964	Roadside	100.0	100.0	**40.6**	37.2	35.1	31.3	31.7
CB61	571445	205631	Urban Background	100.0	100.0	17.3	15.5	15.2	13.7	12.6
CB62, CB63, CB64	566463	210830	Rural	100.0	100.0	13.5	11.6	11.6	9.2	9.0
CB65, CB66, CB67	569912	206881	Roadside	100.0	100.0	24.1	23.2	21.4	19.2	18.7

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 2021 (%) [2]	2017	2018	2019	2020	2021
CB68, CB68B, CB68C	571382	206092	Roadside	90.0	90.0	31.9	32.3	29.4	24.6	25.0
CB76, CB76B, CB76C	578506	205122	Roadside	100.0	100.0	**41.8**	36.5	36.3	27.6	31.5
CB79	569480.455	206009.327	Roadside	100.0	100.0	39.5	**41.8**	39.0	32.5	32.4
CB82	571438	206966	Roadside	93.0	93.0	34.6	34.7	31.5	23.9	25.6
CB83	571462	206999	Roadside	82.7	82.7	39.4	36.4	35.8	30.9	31.9
CB84, CB85, CB86	571653	205800	Roadside	100.0	100.0	29.8	26.4	26.4	22.0	21.0
CB87	570444	207044	Urban Centre	91.3	91.3	37.0	35.4	39.6	30.6	30.4
CB89	571426	206979	Kerbside	92.4	92.4	**41.7**	38.5	37.4	31.8	31.3
CB90	571480	207019	Roadside	91.3	91.3	29.6	26.9	26.1	23.1	21.9
CB91, CB92, CB93	578539	205113	Roadside	100.0	100.0	**47.3**	**44.6**	**42.8**	33.9	34.6
CB94	578571	205108	Roadside	100.0	100.0	31.4	27.8	25.0	19.7	21.6
CB95	578415	205106	Roadside	100.0	100.0	26.9	29.4	27.5	20.3	23.4
CB96	578359	205120	Kerbside	100.0	100.0	24.6	29.2	29.8	23.8	22.7
CB98A, CB98B, CB98C	571148	206324	Roadside	100.0	100.0	N/A	**45.9**	**45.8**	38.3	36.8
CB99A, CB99B, CB99C	571211	206274	Roadside	100.0	100.0	N/A	**47.1**	**45.4**	**40.2**	37.5
CB102	578954.31	205131.82	Roadside	100.0	100.0	N/A	N/A	39.4	28.9	31.1
CB103A, CB103B, CB103C	578476.76	205110.58	Roadside	100.0	100.0	N/A	N/A	36.9	29.6	30.7

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 2021 (%) [2]	2017	2018	2019	2020	2021
CB104	577583	205360	Roadside	100.0	100.0	N/A	N/A	29.2	23.5	25.7
CB107	569976.94	205233.94	Roadside	100.0	100.0	N/A	N/A	**41.6**	38.6	37.6
CB108	578487.544	205139.213	Urban Background	100.0	100.0	N/A	N/A	17.8	14.8	14.4
CB109	570456.126	207024.951	Roadside	91.3	91.3	N/A	N/A	33.7	24.8	24.4
CB110A, CB110B, CB110C	569982.25	205263.95	Roadside	100.0	100.0	N/A	N/A	25.4	24.3	21.6
CB111A, CB111B, CB111C	569996.04	205198.82	Roadside	100.0	100.0	N/A	N/A	N/A	25.9	29.2
CB112A, CB112B, CB112C	580275	198121	Roadside	100.0	100.0	N/A	N/A	N/A	N/A	26.3
CB113	570659	210483	Roadside	91.6	91.6	N/A	N/A	N/A	N/A	25.1
CB114	567537	216958	Roadside	100.0	100.0	N/A	N/A	N/A	N/A	17.8
CB115	579847	199337	Kerbside	100.0	100.0	N/A	N/A	N/A	N/A	25.6
CB116	572683	209617	Urban Background	91.6	91.6	N/A	N/A	N/A	N/A	15.1
CB117	572642	209674	Kerbside	91.6	91.6	N/A	N/A	N/A	N/A	29.9

☒ **Annualisation has been conducted where data capture is <75% and >25% 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 A.1 – Trends in Annual Mean NO_2 Concentrations within the vicinity of the Army & Navy AQMA

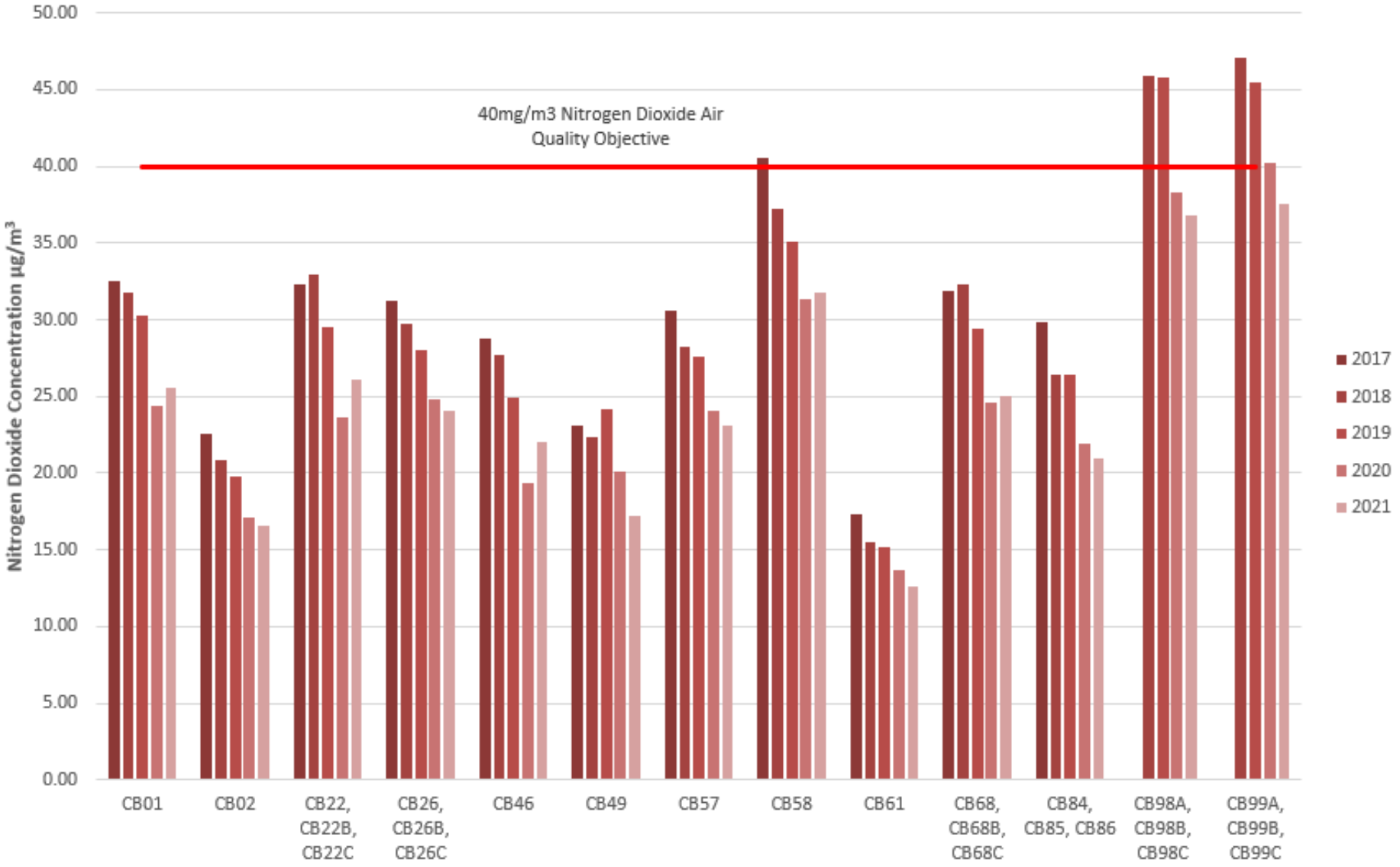


Figure A.2 – Trends in Annual Mean NO_2 Concentrations within the vicinity of the Danbury AQMA

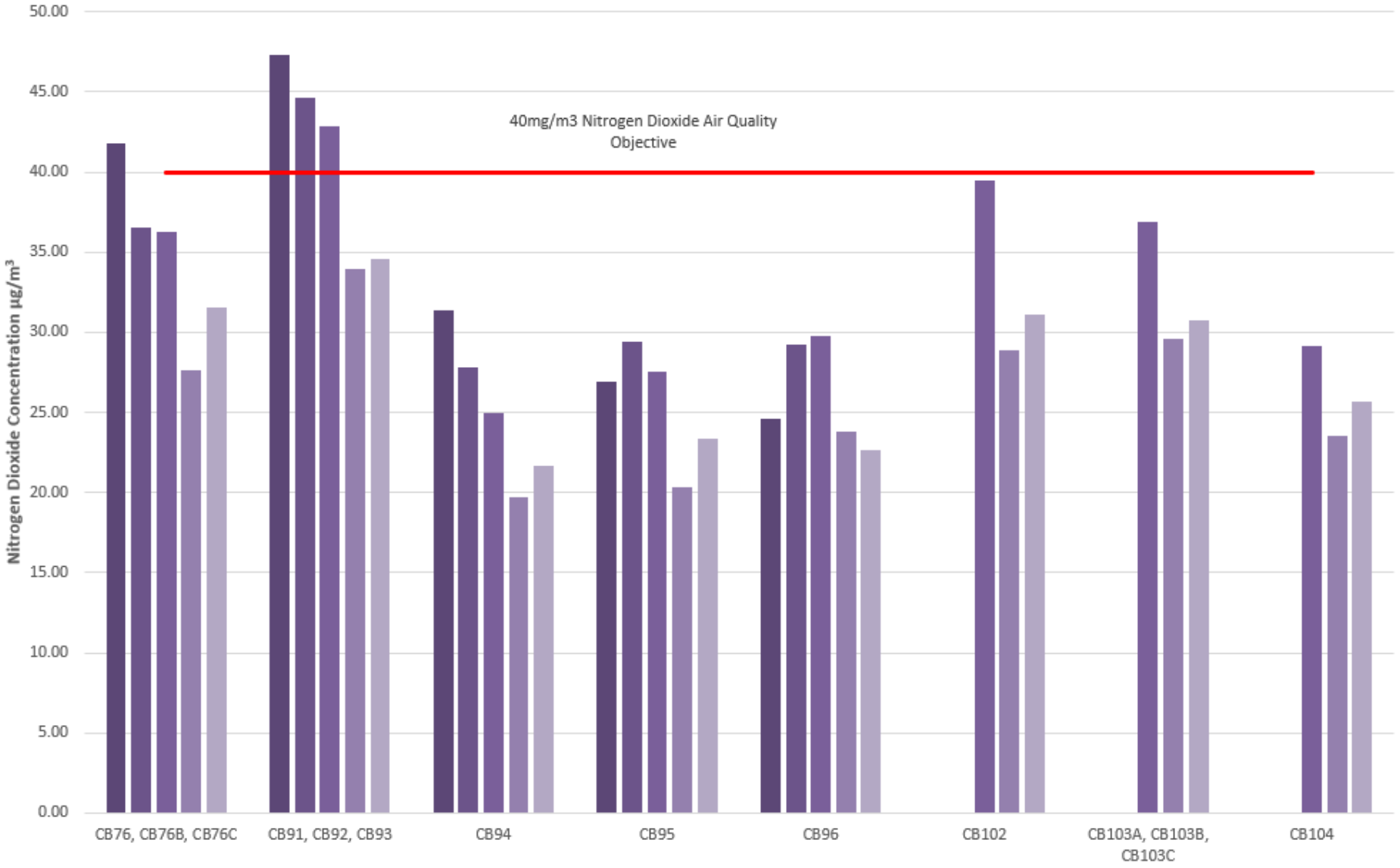


Table A.5 – 1-Hour Mean NO_2 Monitoring Results, Number of 1-Hour Means > 200µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
CM1	566463	210830	Rural	92.2	92.2	0	0	0	**0 (57.73)**	0
CM2	571640	207179	Roadside	95.8	95.8	0	0	0	**0 (74.56)**	0
CM3	569912	206881	Roadside	95.81	95.81	0	0	0	0	0
CM4	571654	205798	Roadside	96.76	96.76	0	0	0	0	0

Notes:

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

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

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

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

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

Table A.6 – Annual Mean PM_{10} Monitoring Results (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 2021 (%) [2]	2017	2018	2019	2020	2021
CM1	566463	210830	Rural	93.93	93.93	16.2	13.5	15.9	12.4	10.9
CM2	571640	207179	Roadside	95.5	95.5	28.8	27.0	25.3	21.9	24.7
CM3	569912	206881	Roadside	96.46	96.46	20.0	17.7	18.7	21.4	24.0

☒ **Annualisation has been conducted where data capture is <75% and >25% 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 A.3 – Trends in Annual Mean PM_{10} Concentrations

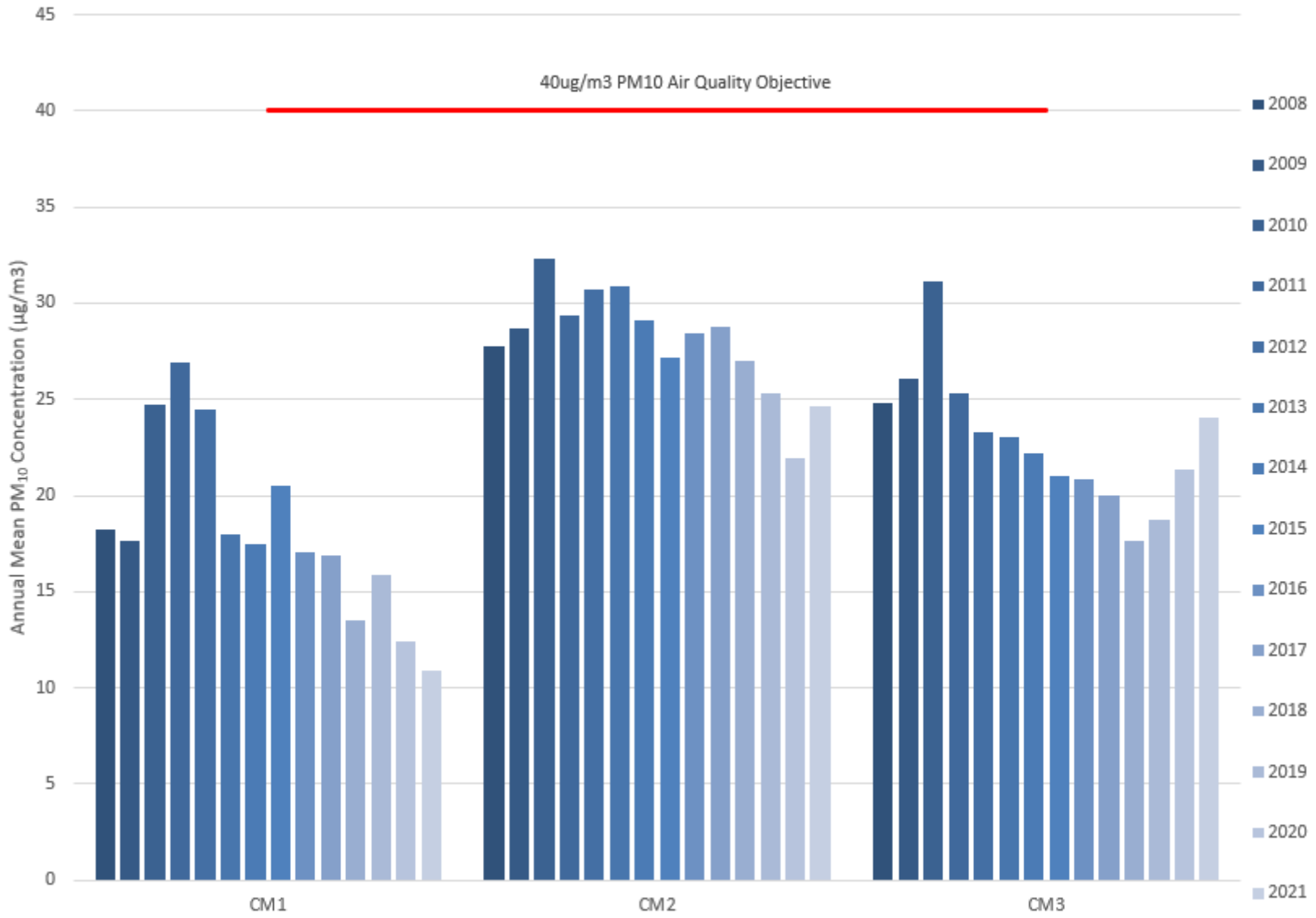


Table A.7 – 24-Hour Mean PM_{10} Monitoring Results, Number of PM_{10} 24-Hour Means > 50µg/m^3

Site ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2021 (%) (2)	2017	2018	2019	2020	2021
CM1	566463	210830	Rural	93.93	93.93	5	1	3	0	0
CM2	571640	207179	Roadside	95.5	95.5	15	12	13	2	5
CM3	569912	206881	Roadside	96.46	96.46	5	2	2	2	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%).

Table A.8 – Annual Mean $PM_{2.5}$ Monitoring Results (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 2021 (%) (2)	2017	2018	2019	2020	2021
CM2	571640	207179	Roadside	88.25	88.25	N/A	N/A	11.4	10.2	10.9

☒ **Annualisation has been conducted where data capture is <75% and >25% in line with LAQM.TG16**

Notes:

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

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 A.4 – Measured Annual Mean $PM_{2.5}$ Concentrations

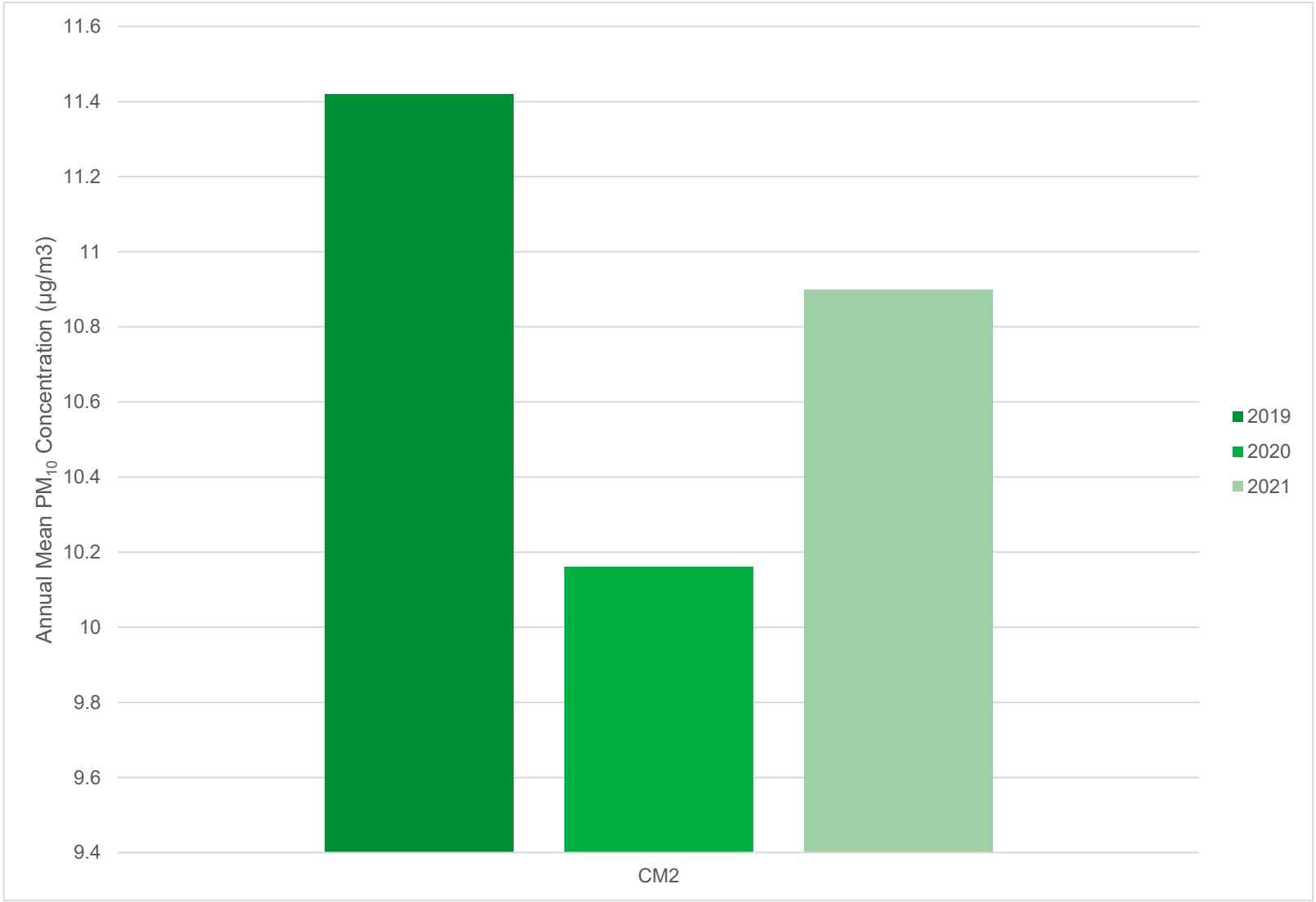
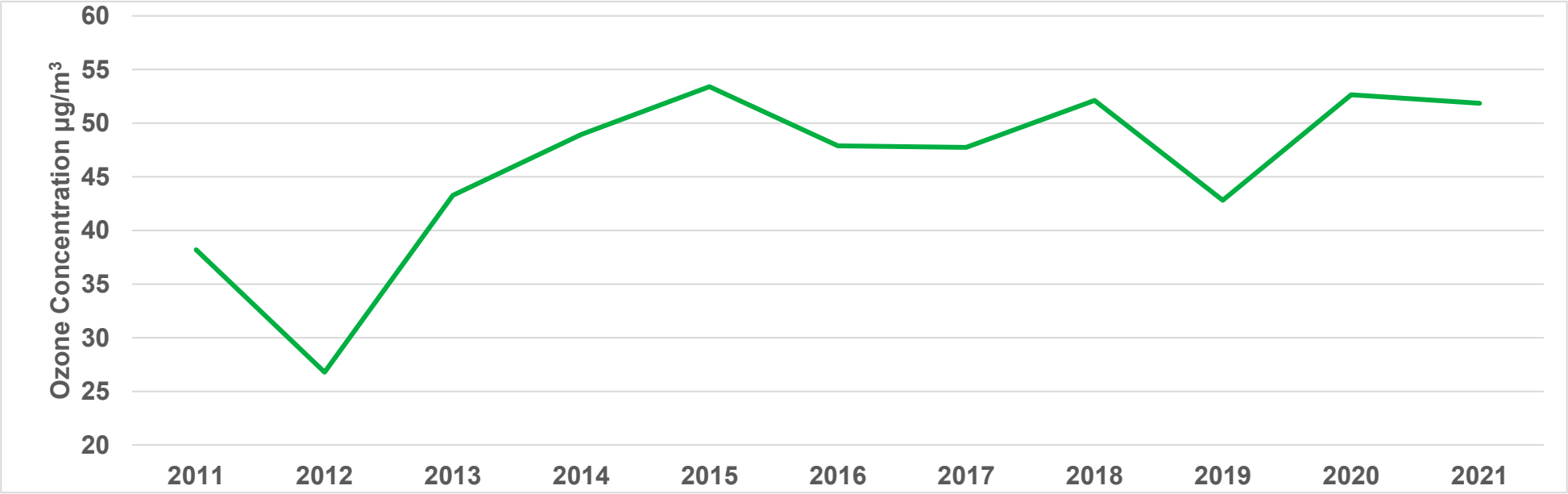


Table A.9 – Ozone (O_3) 2021 Monitoring Results

Site ID	Site Type	Valid Data Capture for Monitoring Period (%) (1)	Valid Data Capture 2019 (%) (2)	O_3 Annual Mean										
				2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
CM1	Rural	83.84	83.84	38.2	26.8	43.3	48.9	53.4	47.9	47.7	52.1	42.8	52.7	51.8

Figure A.5 – Trends in Annual Mean Ozone (O_3) Concentrations



Appendix B: Full Monthly Diffusion Tube Results for 2021

Table B.1 – NO_2 2021 Diffusion Tube Results (µg/m^3)

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.78)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
CB01	571421	205963	35.9	34.4	29.8	34.7	30.8	25.5	31.4	32.5	34.2	31.6	36.4	36.3	32.8	25.6		
CB02	571388	205725	28.5	25.5	23.6	15.1	16.8	14.0	Missing	15.8	23.8	24.5	20.9	25.3	21.3	16.6	-	
CB13	569077	207528	25.8	21.6	20.4	15.5	16.7	12.5	12.3	13.4	20.3	21.4	24.2	22.1	18.9	14.7		
CB22, CB22B, CB22C	571505	205968	33.2	35.2	33.5	34.9	32.6	29.1	28.6	34.2	33.8	37.1	38.7	30.7	33.5	26.1		
CB26, CB26B, CB26C	571614	205812	33.4	33.3	34.0	27.3	29.3	28.0	24.0	25.4	34.9	35.2	36.2	28.9	30.8	24.0		
CB27	574080	203469	38.4	34.0	40.6	20.3	31.5	26.3	22.6	24.5	40.9	44.9	41.5	38.5	33.7	26.3		
CB32	571581	207144	39.8	31.6	34.9	Missing	28.3	25.0	17.9	22.7	31.2	37.5	43.8	37.6	31.8	24.8		
CB33	570974	207157	36.5	28.9	35.1	33.1	29.7	22.6	24.4	27.1	37.2	39.1	43.3	Missing	32.5	25.3		
CB36	570104	207247	27.9	32.3	28.2	24.6	22.3	21.5	21.8	23.7	32.2	31.7	31.0	39.8	28.1	21.9		
CB38, CB39, CB40	571640	207179	32.0	26.5	30.2	25.2	25.4	24.8	18.7	22.6	30.7	33.2	36.4	33.0	28.2	22.0		
CB46	571062	206281	25.9	31.4	28.5	27.2	28.5	26.0	24.0	29.1	31.1	27.8	32.3	26.7	28.2	22.0		
CB49	571104	206262	27.1	22.5	27.1	Missing	17.1	18.3	15.5	18.7	23.5	22.4	29.3	21.9	22.1	17.3		
CB52	571367	207014	37.8	28.9	31.1	18.8	29.2	25.6	24.3	22.7	30.2	41.1	37.9	40.7	30.7	23.9		
CB57	571359	206124	31.7	29.2	29.9	24.8	28.0	25.8	27.3	24.6	35.3	33.5	33.1	32.0	29.6	23.1		
CB58	571476	205964	37.9	38.3	46.1	34.8	43.0	36.5	36.8	36.3	46.4	45.8	45.0	41.3	40.7	31.7		
CB61	571445	205631	22.4	19.5	21.2	12.9	12.8	5.9	9.4	10.5	15.9	17.6	22.8	22.6	16.1	12.6		
CB62, CB63, CB64	566463	210830	16.7	13.2	13.4	6.2	9.9	6.5	6.4	6.4	14.2	14.4	15.9	15.0	11.5	9.0		
CB65, CB66, CB67	569912	206881	28.7	26.5	25.8	17.6	18.2	17.1	18.0	20.2	26.1	27.9	32.1	28.9	23.9	18.7		
CB68, CB68B, CB68C	571382	206092	35.0	38.2	29.0		35.3	22.7	31.6	27.2	35.2	34.6	30.6	33.0	32.0	25.0		
CB76, CB76B, CB76C	578506	205122	43.6	38.4	42.3	36.1	39.6	33.6	32.5	34.1	47.8	44.7	51.8	40.3	40.4	31.5		
CB79	569480	206009	35.5	43.8	44.7	41.8	43.7	32.3	38.2	39.3	45.8	44.6	43.6	45.2	41.5	32.4		
CB82	571438	206966	33.7	30.9	30.7	31.0	38.2	21.7	31.6	29.0	Missing	39.2	38.0	37.2	32.8	25.6		
CB83	571462	206999	51.1	35.1	36.3	32.6	37.4	Missing	Missing	32.2	48.9	45.5	45.2	44.4	40.9	31.9		

DT ID	X OS Grid Ref (Easting)	Y OS Grid Ref (Northing)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean: Raw Data	Annual Mean: Annualised and Bias Adjusted (0.78)	Annual Mean: Distance Corrected to Nearest Exposure	Comment
CB84 CB85 CB86	571653	205800	32.4	25.6	30.8	20.5	25.5	22.1	20.5	20.9	27.1	31.9	35.4	30.6	26.9	21.0		
CB87	570444	207044	33.2	36.9	43.8	31.5	41.9	Missing	34.6	31.3	47.8	42.6	46.1	38.8	39.0	30.4		
CB89	571426	206979	42.7	Missing	43.7	33.7	36.5	29.8	26.1	38.4	46.7	45.7	51.9	45.8	40.1	31.3		
CB90	571480	207019	28.2	29.0	29.6	25.5	28.4	21.9	20.2	20.9	33.4	34.8	37.6	Missing	28.1	21.9		
CB91, CB92, CB93	578539	205113	42.8	47.8	47.2	35.7	49.3	40.0	38.7	28.7	53.9	50.7	51.1	46.7	44.4	34.6		
CB94	578571	205108	31.4	28.7	30.3	26.9	28.5	23.5	19.6	23.6	32.1	28.6	32.1	27.7	27.8	21.6		
CB95	578415	205106	30.3	39.3	29.0	28.6	27.6	25.4	26.0	24.4	33.7	30.7	34.6	29.9	30.0	23.4		
CB96	578359	205120	37.3	26.0	34.1	22.4	28.4	21.0	20.6	13.6	37.9	36.2	38.3	33.2	29.1	22.7		
CB98A CB98B CB98C	571148	206324	47.5	34.5	56.3	45.3	52.3	41.7	42.8	40.5	54.3	52.0	52.2	45.9	47.1	36.8		
CB99A CB99B CB99C	571211	206274	52.3	39.0	52.6	38.6	48.9	44.8	43.3	37.3	58.5	55.6	54.6	51.6	48.1	37.5		
CB102	578954	205132	41.9	40.1	39.4	37.2	41.9	35.2	34.8	35.0	47.6	43.8	42.8	39.3	39.9	31.1		
CB103A CB103B CB103C	578477	205111	43.3	41.3	37.7	37.0	36.7	37.8	34.6	30.0	43.9	42.1	47.5	40.4	39.4	30.7		
CB104	577583	205360	38.1	34.4	35.3	27.5	32.1	27.7	28.5	24.7	32.8	34.5	42.2	37.8	33.0	25.7		
CB107	569977	205234	54.5	48.1	55.3	37.3	50.9	33.2	27.7	39.4	59.7	56.3	67.7	48.9	48.3	37.6		
CB108	578488	205139	26.2	21.2	19.1	11.7	16.0	12.7	13.1	10.8	20.7	21.1	25.9	22.6	18.4	14.4		
CB109	570456	207025	35.7	33.0	32.6	28.1	27.4	Missing	24.9	27.7	30.1	36.8	37.8	30.5	31.3	24.4		
CB110A, CB110B, CB110C	569982	205264	32.5	25.9	30.8	24.4	26.7	24.4	20.7	22.8	32.9	30.1	32.1	28.3	27.6	21.6		
CB111A, CB111B, CB111C	569996	205199	36.5	33.9	37.6	32.5	39.1	37.3	30.6	31.7	49.5	45.3	39.8	36.2	37.5	29.2		
CB112A, CB112B, CB112C	580275	198121	37.5	36.5	32.0	27.5	35.2	28.1	28.2	24.0	39.0	36.1	40.3	40.3	33.7	26.3		
CB113	570659	210483	32.8	37.5	33.3	32.1	27.0	32.1	26.4	29.6	38.3	33.7	Missing	31.3	32.2	25.1		
CB114	567537	216958	25.0	27.3	22.8	18.2	24.6	16.3	19.0	12.4	30.3	27.3	26.3	23.9	22.8	17.8		
CB115	579847	199337	34.0	34.0	45.7	36.8	22.7	27.6	23.5	27.8	37.3	43.9	26.6	34.0	32.8	25.6		
CB116	572683	209617	23.4	22.8	21.8	17.9	18.9	14.0	15.7	13.4	22.2	23.3	Not Analysed By Lab	19.2	19.3	15.1		
CB117	572642	209674	39.3	42.5	41.6	33.0	33.5	31.7	31.1	20.6	53.3	50.2	Not Analysed By Lab	45.1	38.4	29.9		

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

☒ **National bias adjustment factor used**

☒ **Chelmsford City Council confirm that all 2021 diffusion tube data has been uploaded to the Diffusion Tube Data Entry System**

It has not been necessary for any data to distance corrected for relevant exposure in the final column

It has not been necessary for any data annualisation where data capture is <75% and >25% in line with LAQM.TG16

Notes:

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

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

See Appendix C for details on bias adjustment and annualisation.

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

New or Changed Sources Identified Within Chelmsford During 2021

Chelmsford City Council has not identified any significant new sources relating to air quality within the reporting year of 2021.

Additional Air Quality Works Undertaken by Chelmsford City Council During 2021

Chelmsford City Council has not completed any additional air quality works within the reporting year of 2021.

QA/QC of Diffusion Tube Monitoring

- Chelmsford City Council undertook monitoring using 77 nitrogen dioxide diffusion tubes at 47 sites in 2021.
- Chelmsford City Council adheres with the Diffusion Tube Monitoring Calendar although it is acknowledged that there may be occasional slight deviation due to resources.
- The diffusion tubes were supplied by Socotec (UKAS Testing Laboratory number 1015) with a preparation method of 50% triethanolamine (TEA) in Acetone.
- The AIR NO_2 proficiency testing scheme found that the laboratory achieved the following percentage of results determined as satisfactory for 2021:

Table C.1 – AIR PT Results 2021

AIR PT Round	AIR PT AR42
Round conducted in the period	January – March 2021
SOCOTEC	100%

Diffusion Tube Annualisation

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

Diffusion Tube Bias Adjustment Factors

The diffusion tube data presented within the 2022 ASR have been corrected for bias using an adjustment factor. Bias represents the overall tendency of the diffusion tubes to under or over-read relative to the reference chemiluminescence analyser. LAQM.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.

A summary of bias adjustment factors used by Chelmsford City Council over the past five years is presented in Table C.2.

Table C.2 – Bias Adjustment Factor

Monitoring Year	Local or National	Diffusion Tube	If National, Version of National Spreadsheet	Adjustment Factor
2021	National	Socotec 50% TEA in Acetone	03/22	0.78
2020	National	Socotec 50% TEA in Acetone	03/21	0.77
2019	National	Socotec 50% TEA in Acetone	03/20	0.75
2018	National	ESG Didcot 50% TEA in Acetone	03/19	0.76
2017	National	ESG Didcot 50% TEA in Acetone	03/18	0.77

Chelmsford City Council undertakes co-location studies at all four automatic air quality monitoring stations. The data collected at these has been used to calculate a local bias adjustment for comparison.

The local bias adjustment has been undertaken in 2020 and 2021 and both years has been affected by poor overall data capture at one or more automatic analysers.

The national bias adjustment factor of 0.78 has been applied to the 2021 monitoring data to maintain consistency with other Councils in Essex and to exclude issues where poor data capture from the automatic analysers may affect the overall bias adjustment figure.

It is acknowledged that use of the Local Bias Adjustment Figure would lead to higher reported concentrations. However, if the Local Bias Adjustment figure was applied to the 2021 monitoring data, there would still be no exceedances measured at relevant exposure.

Table C.3 – Local Bias Adjustment Calculation

	Local Bias Adjustment Input 1	Local Bias Adjustment Input 2	Local Bias Adjustment Input 3	Local Bias Adjustment Input 4
Periods used to calculate bias	11	10	10	10
Bias Factor A	1 (0.91 - 1.12)	0.79 (0.69 - 0.91)	0.83 (0.77 - 0.89)	0.73 (0.71 - 0.76)
Bias Factor B	0% (-11% - 10%)	27% (10% - 44%)	21% (12% - 30%)	36% (31% - 41%)
Diffusion Tube Mean (µg/m^3)	27.8	11.0	24.0	27.2
Mean CV (Precision)	4.8%	4.7%	7.7%	8.5%
Automatic Mean (µg/m^3)	27.9	8.6	19.8	20.0
Data Capture	96%	95%	95%	96%
Adjusted Tube Mean (µg/m^3)	28 (25 - 31)	9 (8 - 10)	20 (18 - 21)	20 (19 - 21)
Overall Diffusion Tube Precision	**Good Overall Precision**	**Good Overall Precision**	**Good Overall Precision**	**Good Overall Precision**
Overall Continuous Monitor Data Capture	**Good Overall Data Capture**	**Poor Overall Data Capture**	**Good Overall Data Capture**	**Good Overall Data Capture**
Combined Local Bias Adjustment Factor	**0.83**	*Warning - One or more Co-location studies has Poor Overall Continuous Monitor Data Capture (i.e. <90%). Local Bias Adjustment Factor should be treated with caution.*		

NO_2 Fall-off with Distance from the Road

No diffusion tube NO_2 monitoring locations within Chelmsford required distance correction during 2021.

QA/QC of Automatic Monitoring

Chelmsford City Council operates four automatic monitoring sites measuring NO_2, $PM_{2.5}$, PM_{10} and O_3. Data from these sites is collected by a contractor.

Daily data validation checks are made to ensure the analysers are working correctly and to identify any abnormal readings that may occur. Monitoring data is forwarded to the Council.

The fortnightly LSO calibrations and biannual servicing are carried out by a contractor who also makes emergency maintenance callouts when faults are identified.

The nitrogen dioxide analysers are calibrated fortnightly with a certified reference gas. Particulate monitors have their filter tapes changed approximately every two months. All automatic monitoring sites are co-located with triplicate NO_2 diffusion tubes.

Data ratification is undertaken by the Councils contractor and contains the following processes;

- Applying the scaling factors derived from calibrations, maintenance visits and servicing and checking for equipment drift with adjustments made where detected
- Comparison with datasets from other appropriate Essex Air monitoring sites
- Checking for and deletion of erroneous data that can be linked to analyser fault or failure.
- Live and historic data is available online https://www.wecare4air.co.uk/

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

For the monitoring of particulate matter, Chelmsford City Council uses Met One Beta Attenuation Monitors (BAMs).

- The Met One PM_{10} monitors are unheated and require a correction for slope by dividing the raw data by 1.2.
- The Met One $PM_{2.5}$ monitor has a smart heater and does not require correction for slope and/or intercept.

Automatic Monitoring Annualisation

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

NO_2 Fall-off with Distance from the Road

No automatic NO_2 monitoring locations within Chelmsford required distance correction during 2021.

Appendix D: Maps of Monitoring Locations and AQMAs

Figure D.1 – Monitoring Location Map: Army & Navy AQMA

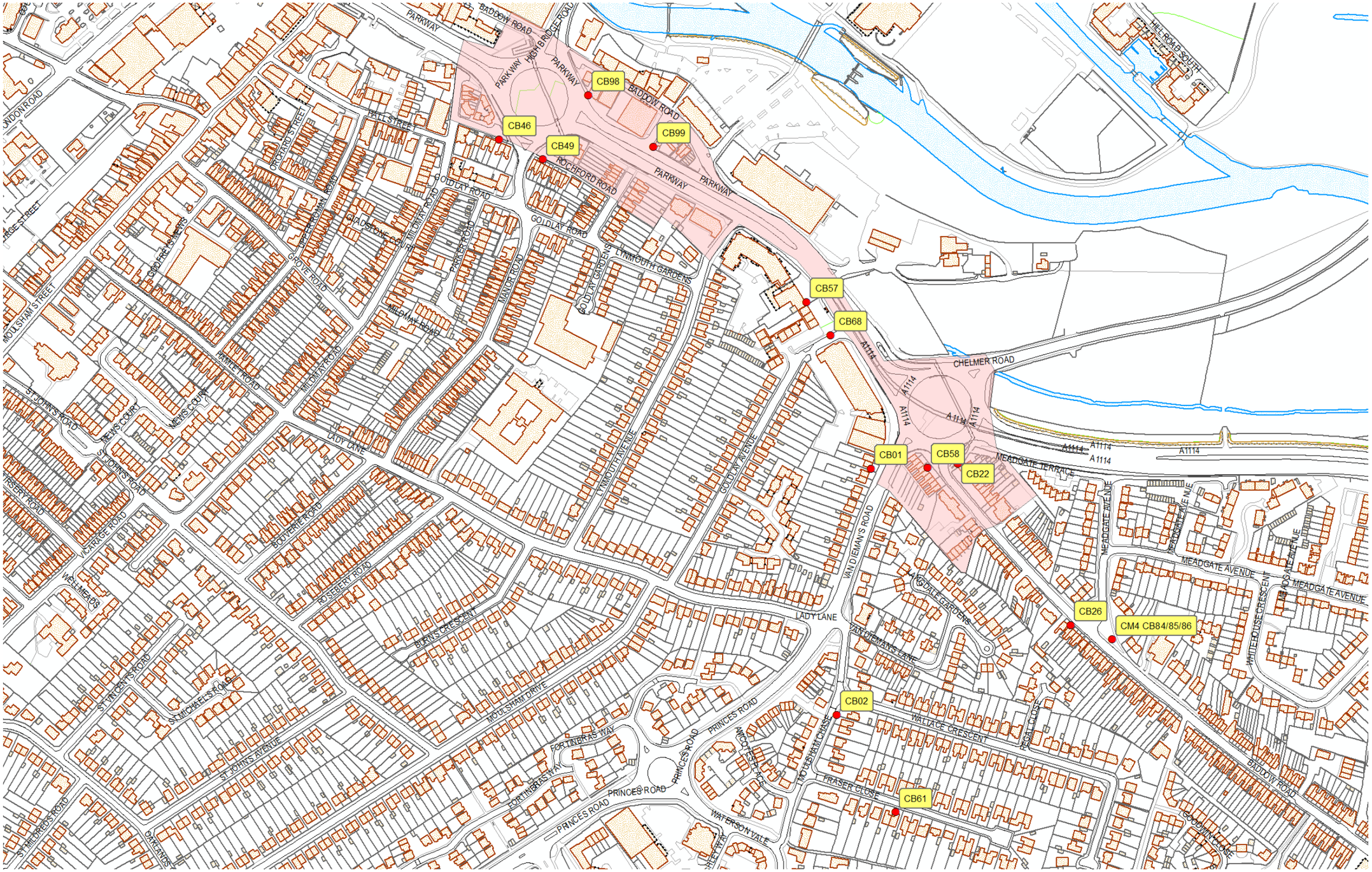


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Figure D.2 – Monitoring Location Map: Chignal St James

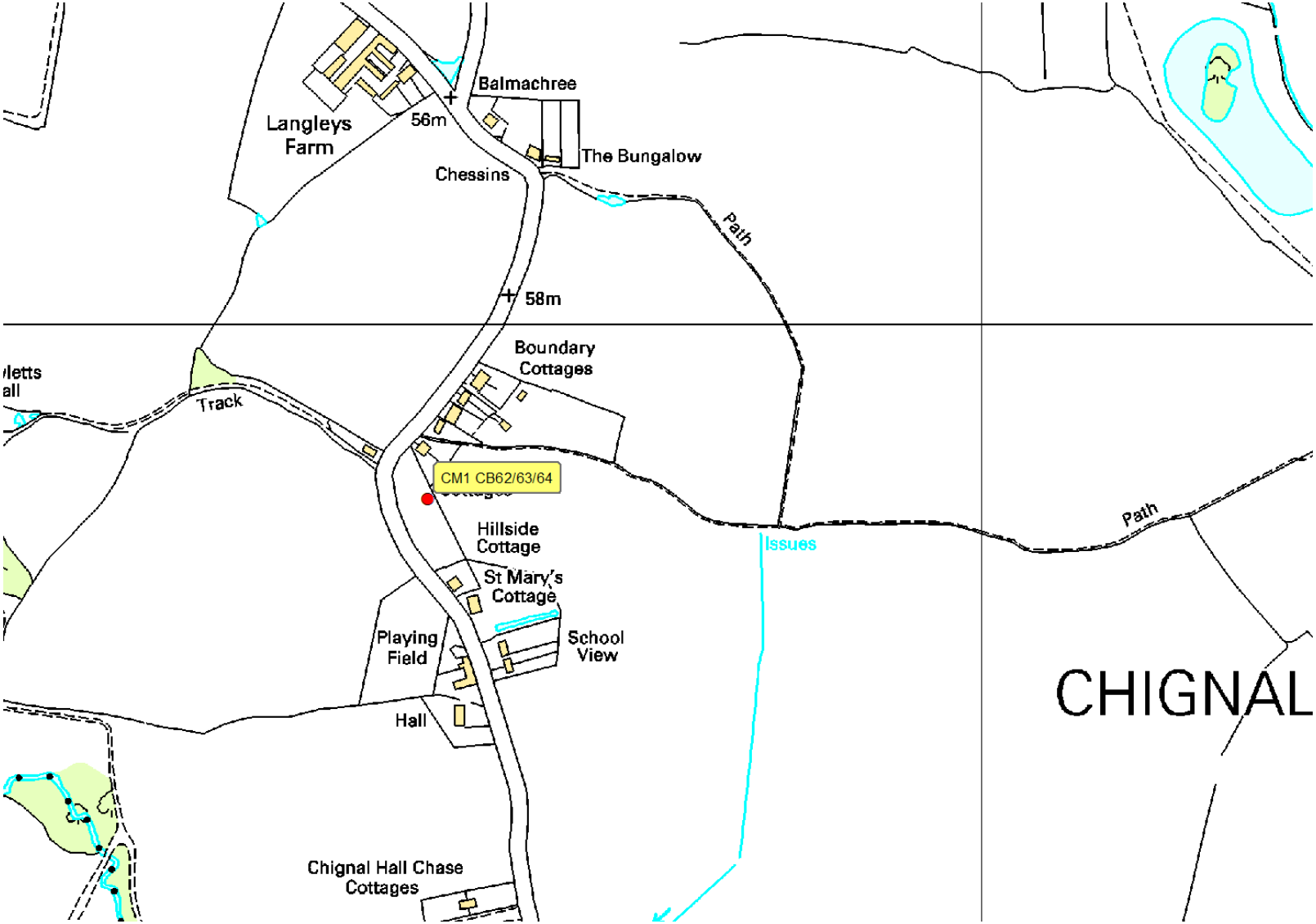

Figure D.3 – Monitoring Location Map: A414 Maldon Road, Danbury AQMA

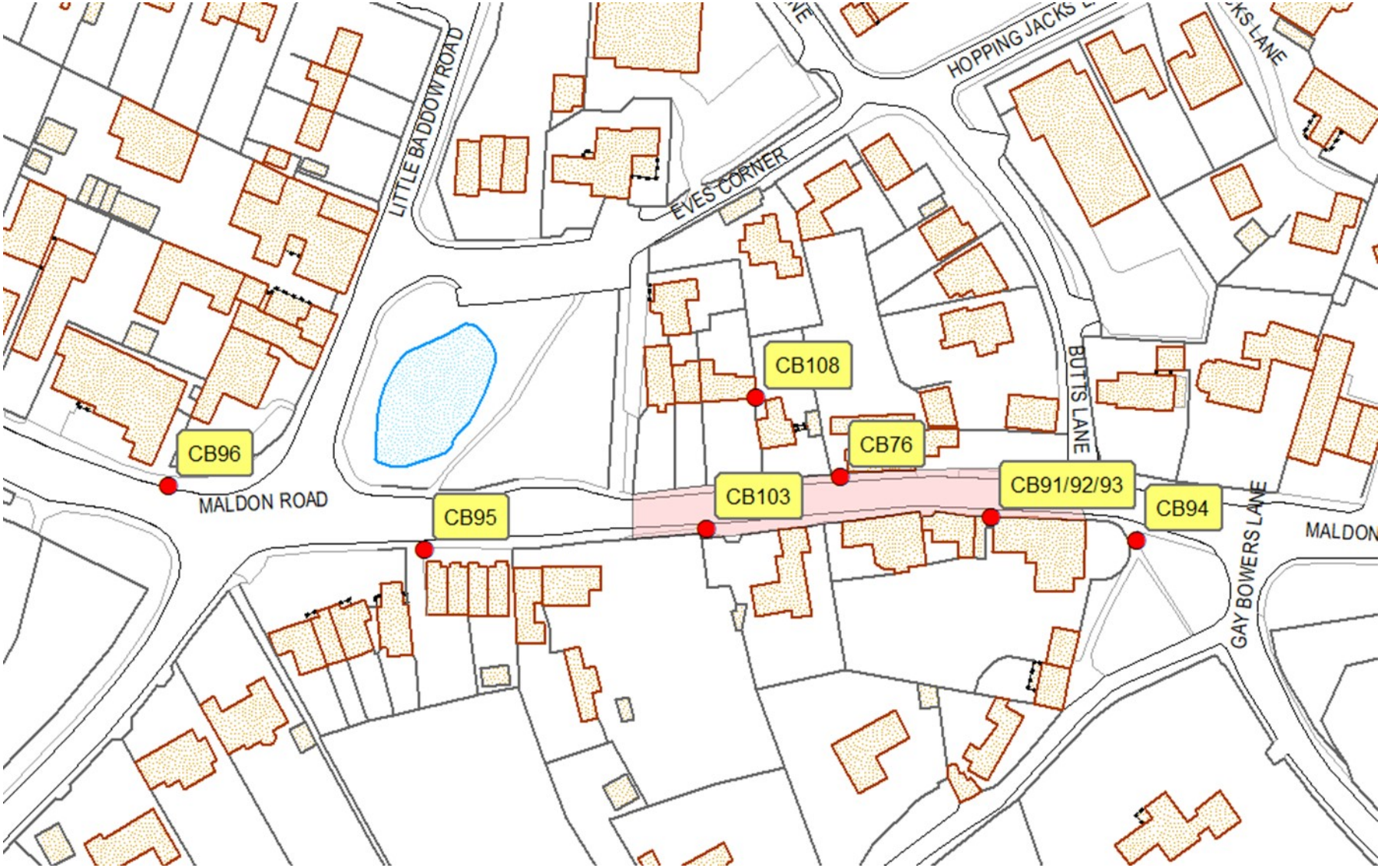

Figure D.4 – Monitoring Location Map: A414 Main Road, Danbury

Figure D.5 – Monitoring Location Map: A414 Maldon Road, Danbury

Figure D.6 – Monitoring Location Map: Springfield Road

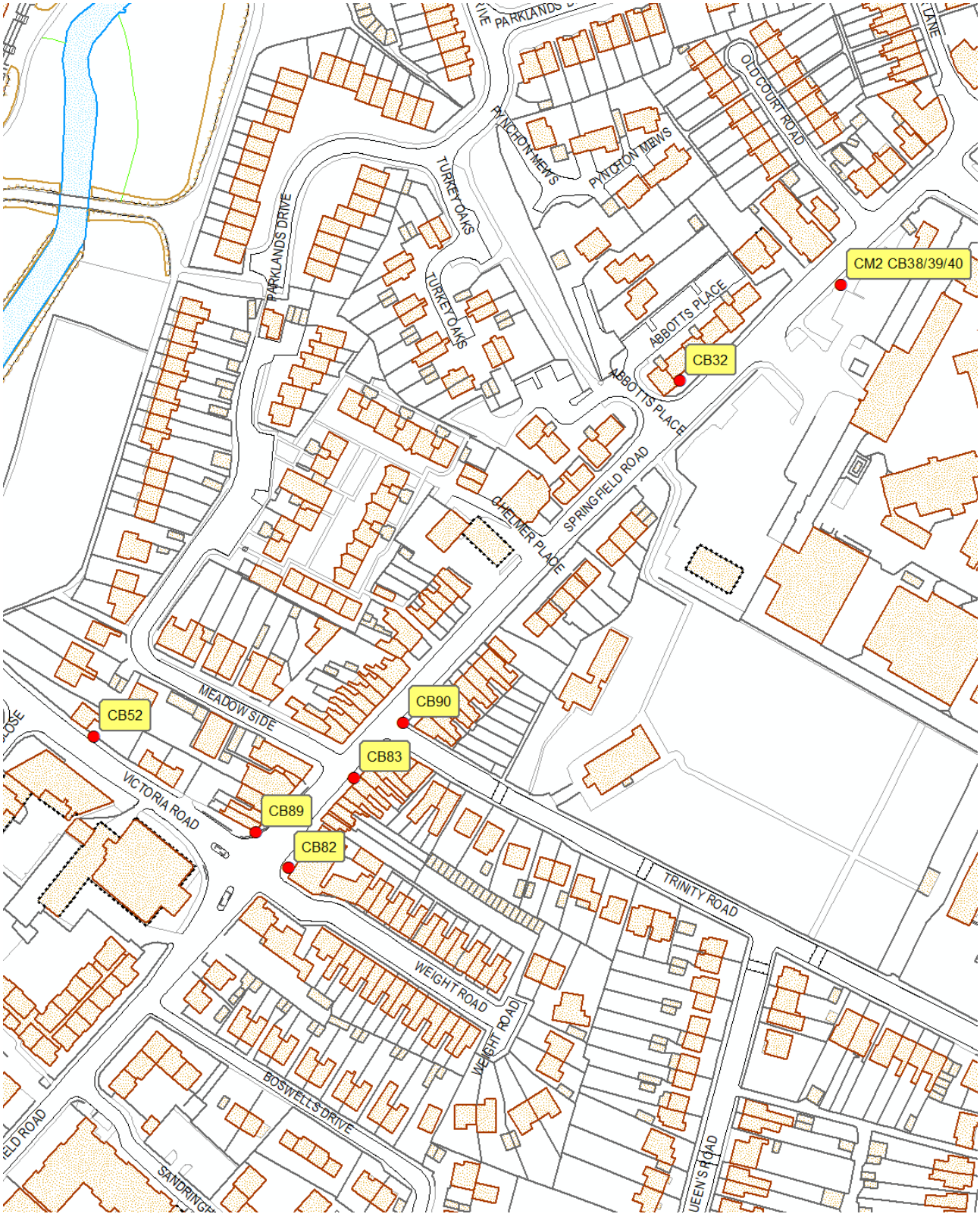

Figure D.7 – Monitoring Location Map: Victoria Road

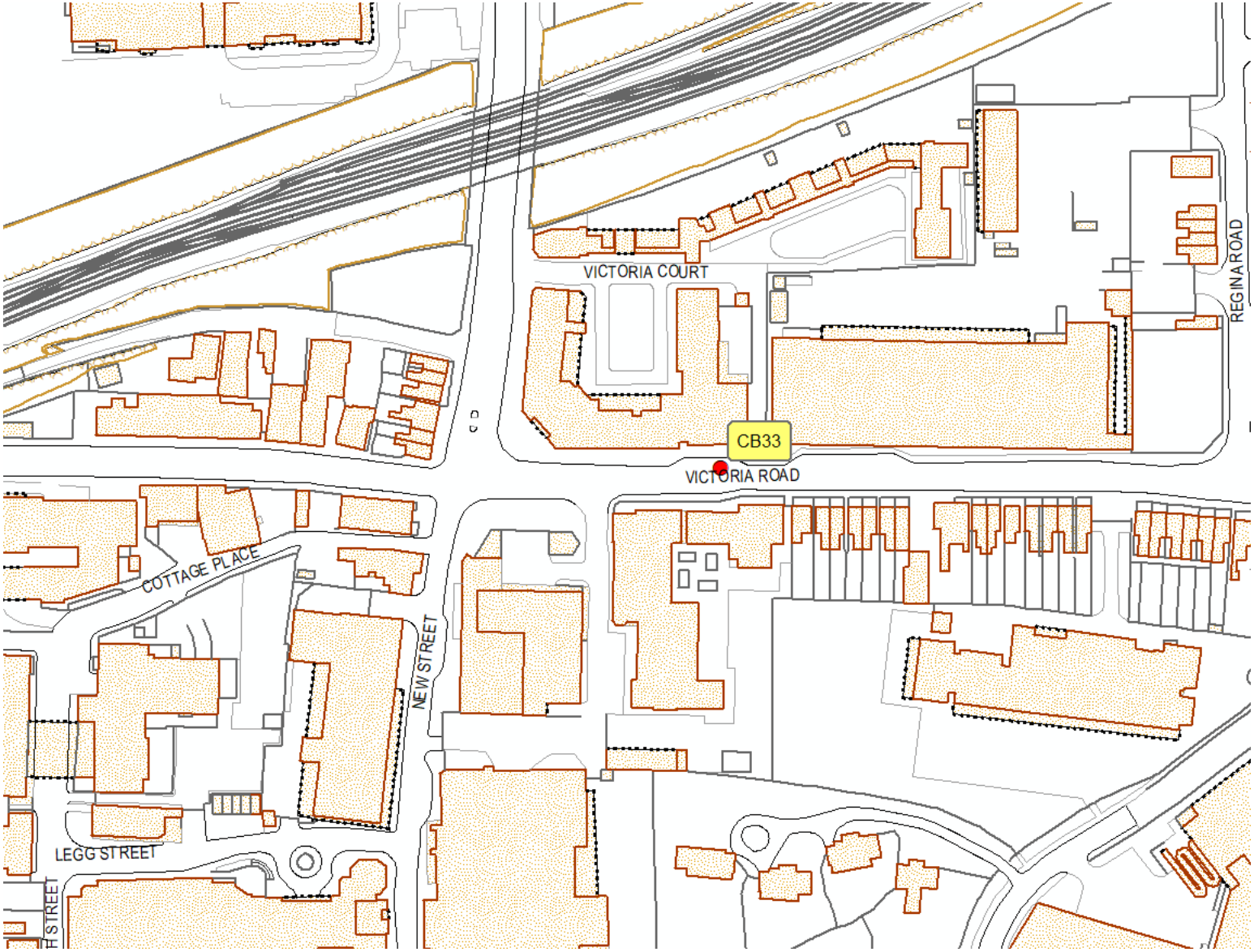

Figure D.8 – Monitoring Location Map: Chelmsford Bus Station

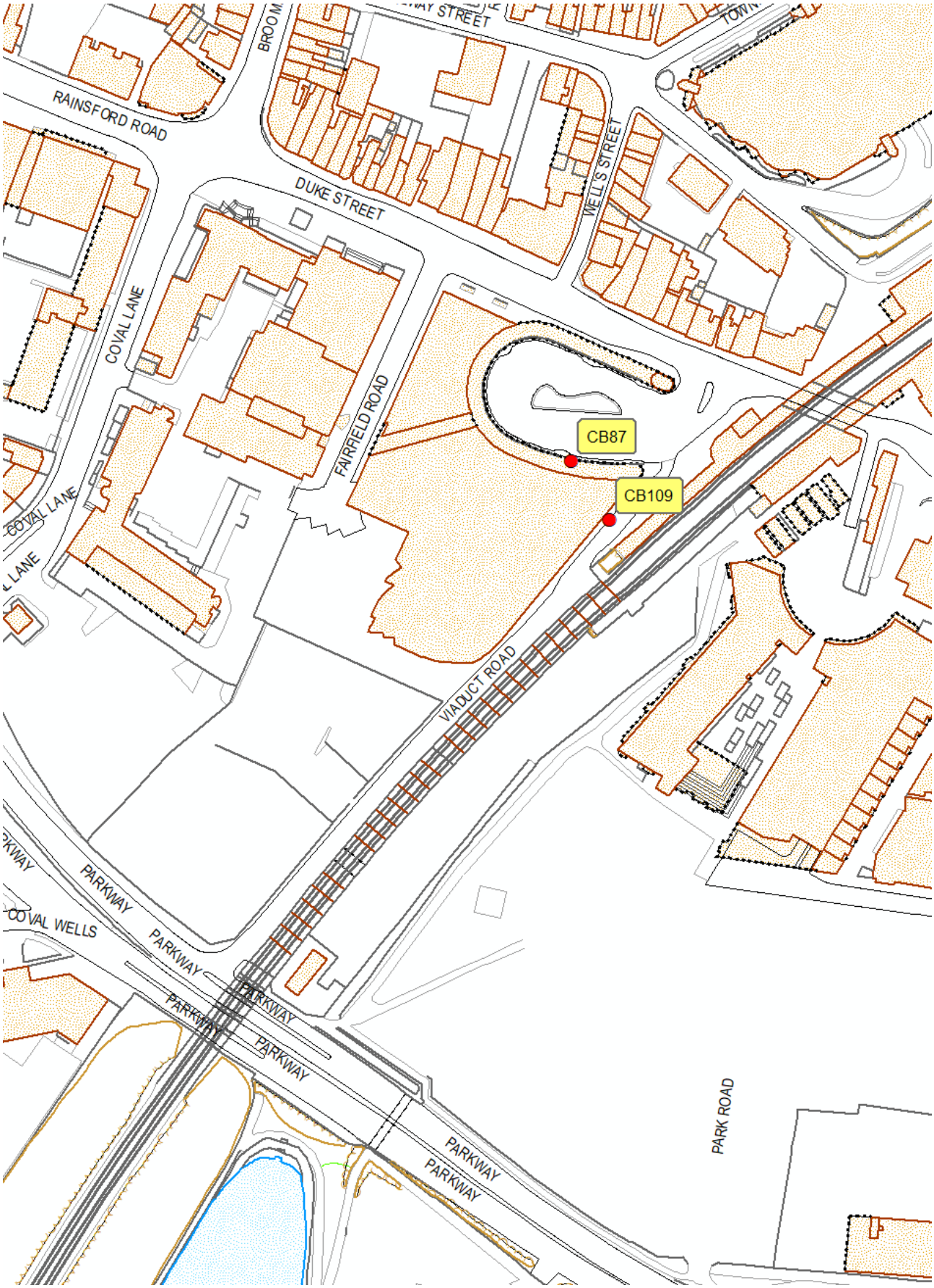

Figure D.9 – Monitoring Location Map: Woodham Ferrers & South Woodham Ferrers

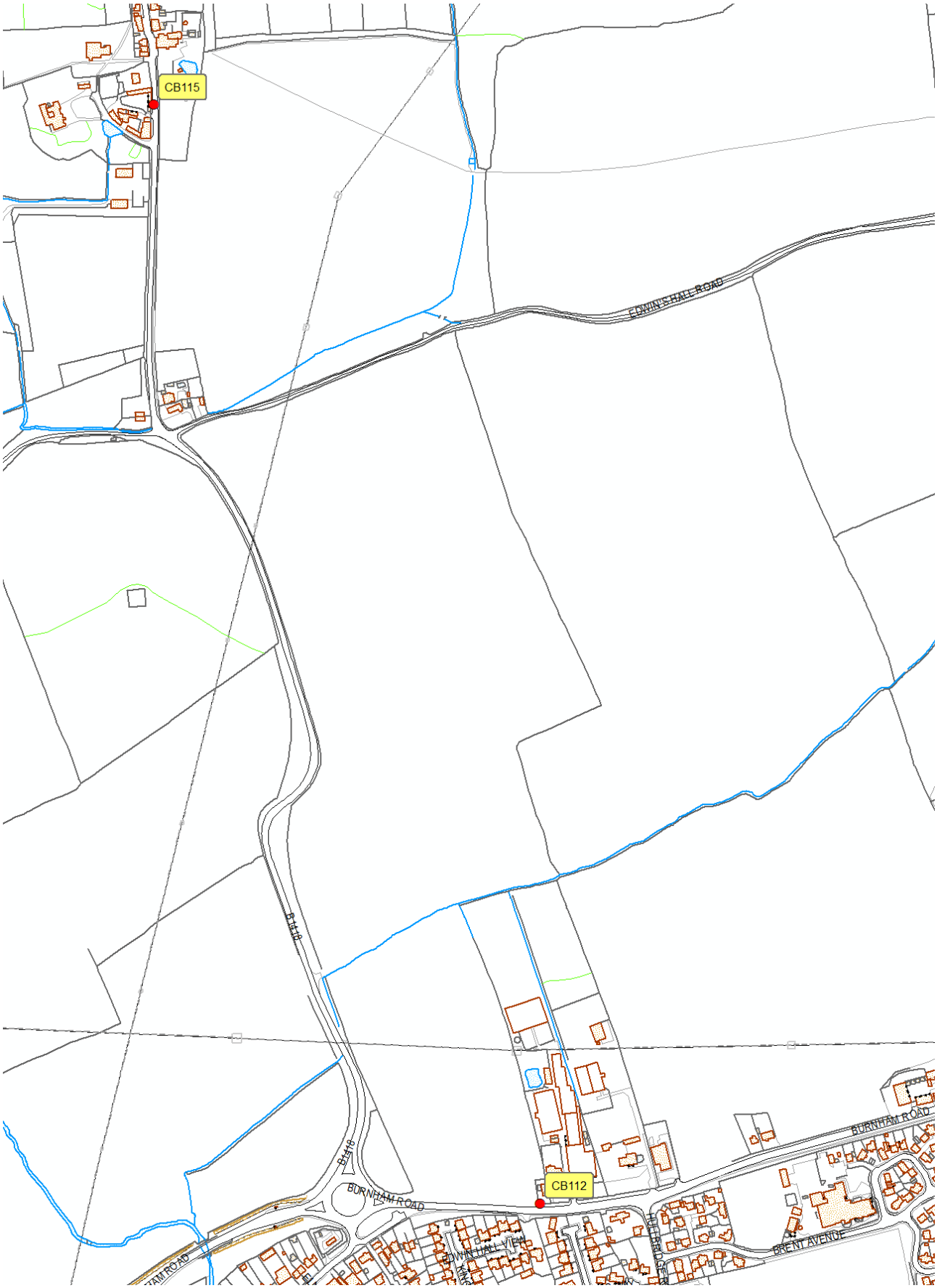

Figure D.10 – Monitoring Location Map: West Chelmsford

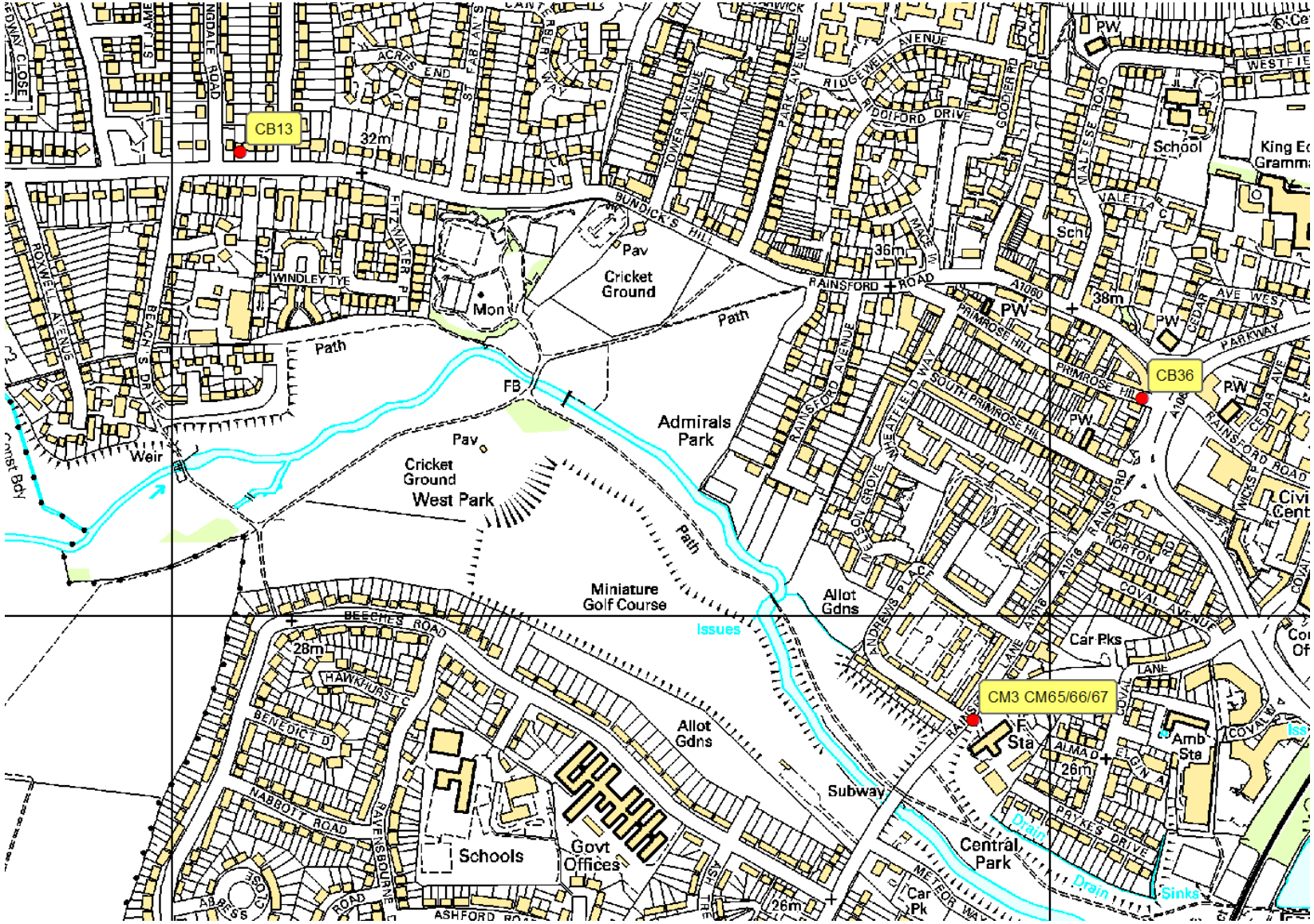

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Figure D.11 – Monitoring Location Map: Broomfield Road

Figure D.12 – Monitoring Location Map: Wood Street

Figure D.13 – Monitoring Location Map: Waterhouse Lane

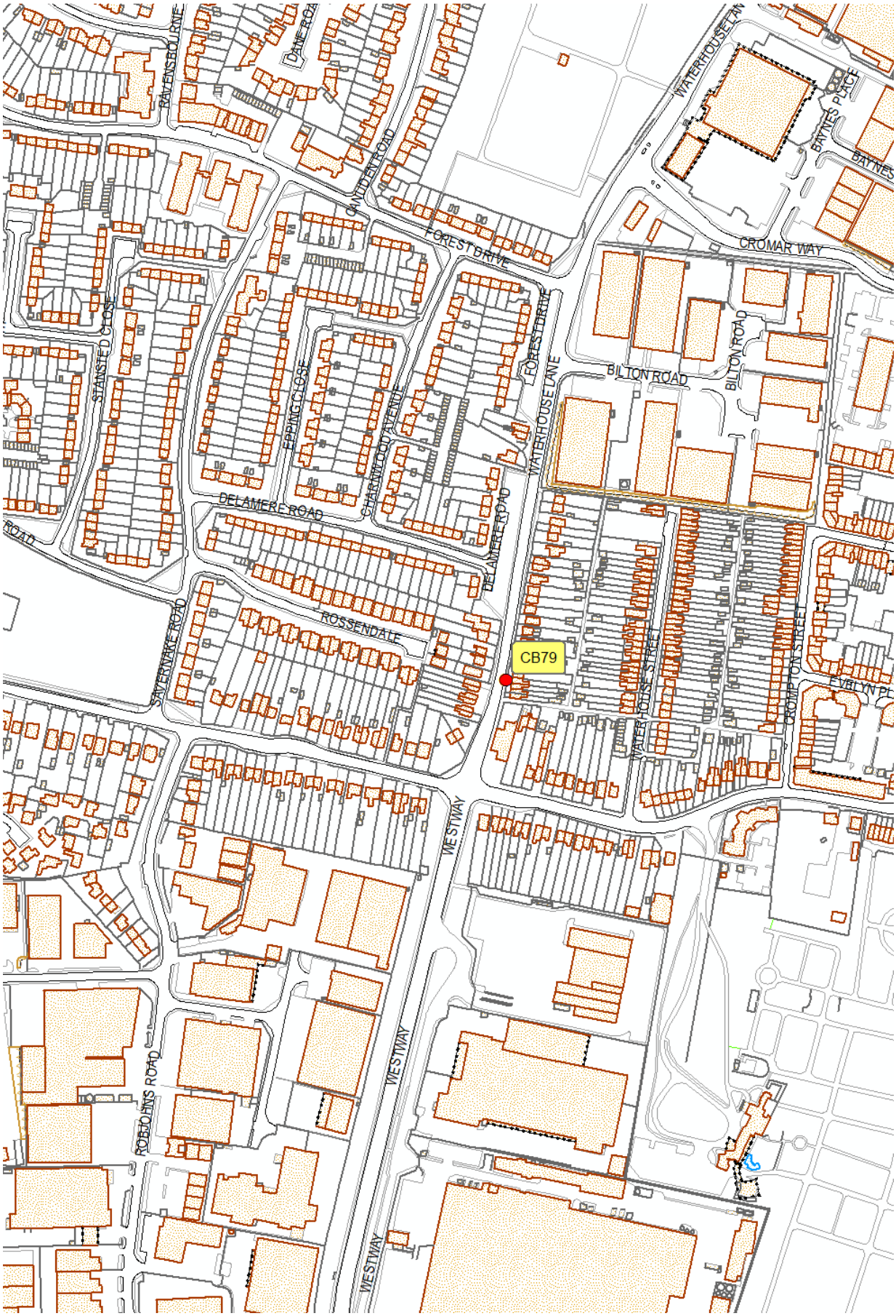

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Figure D.14 – Monitoring Location Map: Ford End

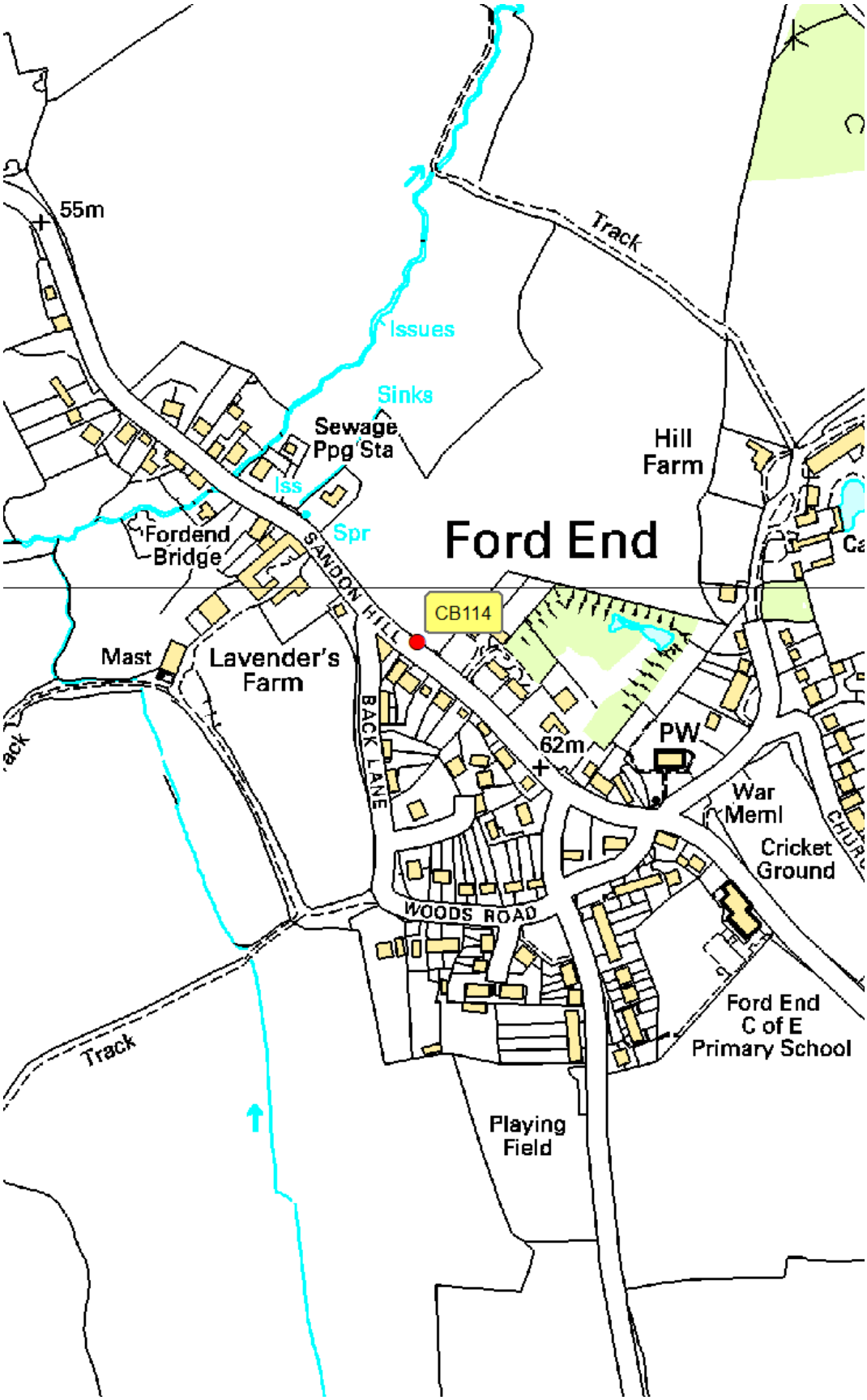
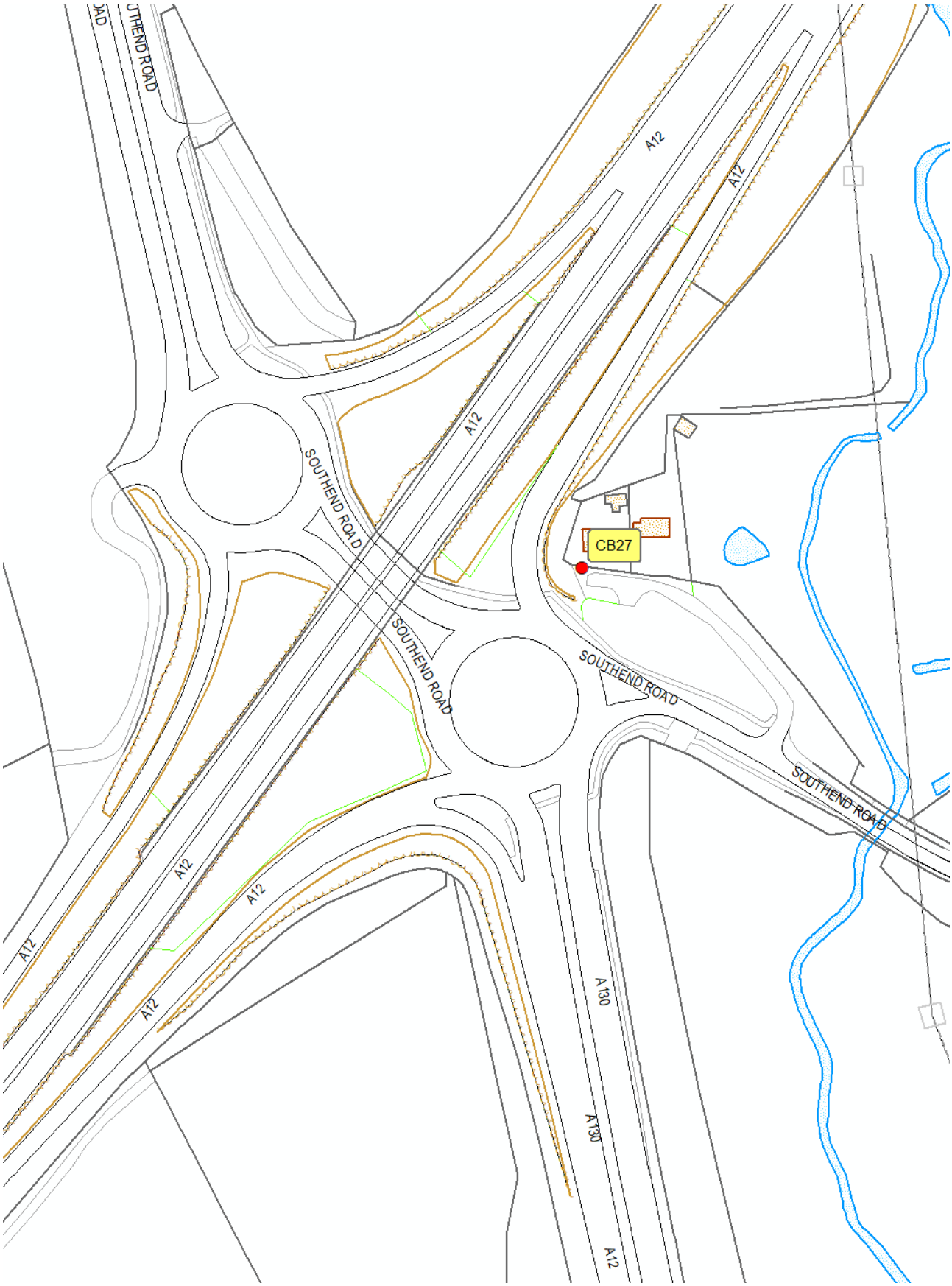


Figure D.15 – Monitoring Location Map: Howe Green



Appendix E: Summary of Air Quality Objectives in England

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

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

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

Glossary of Terms

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

References

- Air Quality Grant Press Release available at; https://www.gov.uk/government/news/116m-boost-for-local-authorities-to-tackle-air-pollution
- Chelmsford City Council Army and Navy Air Quality Action Plan available at; https://uk-air.defra.gov.uk/assets/documents/no2ten/Local_zone29_Chelmsford_AQActionplan_1.pdf
- Chelmsford City Council 2020 ASR available at; https://essexair.org.uk/Reports/Chelmsford-City%20-Council2020-ASR.pdf
- Defra Diffusion Tube Bias Adjustment Factors Spreadsheet available at; https://laqm.defra.gov.uk/bias-adjustment-factors/national-bias.html
- Defra LAQM Summary of Laboratory Performance in AIR NO_2 PT Scheme available at; https://laqm.defra.gov.uk/diffusion-tubes/qa-qc-framework.html
- Essex Air Quality Consortium available at; http://www.essexair.org.uk
- EssexCarShare.com available at; https://liftshare.com/uk/community/essex
- Essex Air Twitter Feed available at; https://twitter.com/essexair
- Essex Highways Active Travel Fund available at; https://www.essexhighways.org/safer-greener-healthier/active-travel-fund
- 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 available at; https://laqm.defra.gov.uk/technical-guidance/
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- Public Health Outcomes Framework Indicator D01 available at; https://fingertips.phe.org.uk/profile/public-health-outcomes-framework
- UK-AIR AQMA Information for Chelmsford City Council available at; https://uk-air.defra.gov.uk/aqma/local-authorities?la_id=53
- We Care 4 Air Online Air Quality Maps available at; https://www.wecare4air.co.uk/