KENT AND MEDWAY AIR QUALITY MONITORING NETWORK

2023 NETWORK ANNUAL REPORT

Report for: Kent and Medway Air Quality Monitoring Partnership (KMAQP)

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GLOSSARY

AQAP	Air Quality Action Plan
AQMA	Air Quality Management Area
AQS	Air Quality Strategy
ASR	Annual Status Report
AURN	Automatic Urban and Rural Network
CO_2	Carbon Dioxide
DAQI	Daily Air Quality Index
Limit Value	Legally binding limit
LGV	Light Goods Vehicles (e.g. vans, small trucks)
Target Value	Limits to be attained where possible by taking all necessary measures not entailing disproportionate costs.
LAQM	Local Air Quality Management
Indicative measurement	Measurements which meet data quality objectives that are representative of indicative classification
NAEI	National Atmospheric Emissions Inventory
NO_2	Nitrogen Dioxide
NOx	Nitrogen Oxides (NOx = NO + NO_2)
O_3	Ozone
PM_{10}	particles that pass through a size-selective inlet with 50% efficiency at an aerodynamic diameter of 10µm
$PM_{2.5}$	particles that pass through a size-selective inlet with 50% efficiency at an aerodynamic diameter of 2.5µm
QAQC	Quality Assurance and Quality Control
SO_2	Sulphur Dioxide

EXECUTIVE SUMMARY

This report provides and overview of the air quality monitoring that was undertaken for the Kent and Medway Air Quality Monitoring Network (KMAQMN) in 2023.

Seventeen automatic air quality monitoring sites were operational during 2023 measuring Nitrogen Dioxide (NO_2), Ozone (O_3), Particulate Matter as PM_{10} and $PM_{2.5}$ and Sulphur Dioxide (SO_2). Three of the seventeen sites also form part of the Automatic Urban and Rural Network (AURN).

Ambient NO_2 is also monitored across the KMAQMN via diffusion tubes - a passive monitoring technique that provides "indicative" measurements of NO_2 for comparison against air quality objectives.

Exceedances of the Air Quality Strategy (AQS) Objectives

One site exceeded the annual mean limit value for NO_2 in 2023. The annual mean NO_2 concentration measured at Maidstone Upper Stone Street was 40.7 μgm^{-3}, which was greater than the 40 μgm^{-3} annual limit value. No sites in the KMAQMN exceeded the hourly mean NO_2 objective of 200 μgm^{-3} more than 18 times.

The annual mean limit values of 40 μgm^{-3} for PM_{10} concentrations and 20 μgm^{-3} for $PM_{2.5}$ concentrations were not exceeded at any site in the KMAQMN. One site exceeded the 24-hour mean objective for PM_{10} of 50 μgm^{-3}, more than the allowable exceedances of 35 times in a year. There were 38 exceedances on the 24-hour mean objective at Swale St Pauls Street in 2023.

Both sites measuring O_3 in the KMAQMN exceeded the 8-hour running meaning objective for O_3 of 100 μgm^{-3}, more than the allowable exceedances of 10 times per year. The Canterbury site exceeded this objective on 21 days, and the Rochester Stoke site exceeded this objective on 17 days in 2023.

All objectives for SO_2 were met at the Rochester Stoke site in 2023.

Pollution episodes

The Daily Air Quality Index (DAQI) was used to assess the number of days of "Moderate", "High" and "Very High" pollution.

No episodes of Moderate, High, or Very High NO_2 or SO_2 were recorded at any sites in the KMAQMN in 2023. Canterbury and Rochester Stoke sites recorded 20 and 16 moderate O_3 days in 2023. One High day for O_3 concentrations was also recorded at Canterbury. There were no instances of Very High days for O_3 recorded at either site.

Of the 15 sites monitoring PM_{10} concentrations, four recorded one or more Moderate days in 2023. Two sites also recorded High days for PM_{10} concentrations. Swale St Pauls Street recorded the highest number of Moderate and High days, 28 and 5 respectively. A Very High day was also recorded at Swale St Pauls Street monitoring site. Five sites also recorded one or more Moderate days for $PM_{2.5}$ concentrations in 2023. A High pollution episode for PM_{10}, $PM_{2.5}$ and O_3 concentrations occurred in September 2023, affecting the majority of the UK.

Long term trends

Annual mean concentrations from 1998 to 2023 from the KMAQMN sites were compared to the UK averages.

During the Covid-19 pandemic, NO_2 concentrations at many sites showed a significant decrease due to traffic volumes reducing during this period. In recent years, some sites have shown a small increase in NO_2 concentrations, however all sites have remained below pre-pandemic concentrations in 2023.

PM_{10} and $PM_{2.5}$ across the KMAQMN have followed the trend of the UK annual averages, showing a general decreasing trend. In 2023, most traffic sites in the KMAQMN showed PM_{10} and $PM_{2.5}$ concentrations greater than the UK annual average.

Annual O_3 concentrations at both Canterbury and Rochester Stoke showed an increase compared to 2022. However, annual O_3 concentrations are highly variable year on year, as O_3 production depends greatly on the meteorological conditions. At Rochester Stoke, annual SO_2 concentrations show a continued decreasing trend,

in line with the UK annual average. This is likely due to the reduction in sulphur fuels and decrease in power plants using coal.

Diffusion tube results

Exceedances in the annual mean NO_2 concentrations measured by diffusion tubes in the network were recorded by the following local authorities:

- Five sites by Maidstone Borough Council
- One site by Medway Council
- One site by Tunbridge Wells Borough Council

1. INTRODUCTION

This report provides details of the air quality monitoring data from the Kent and Medway Air Quality Monitoring Network (KMAQMN) for the calendar year 2023. The network was first formed in 1997 to undertake and report measurements of key air quality pollutants in the Kent and Medway region.

The report presents results and data for nitrogen dioxide (NO_2), particulate Matter (PM_{10} and $PM_{2.5}$), ozone (O_3) and sulphur dioxide (SO_2) from the seventeen continuous monitoring stations that were operational in the network in 2023. NO_2 data from the non-continuous NO_2 diffusion tube monitoring network are also presented here.

Summary statistics of all measured air pollutants and comparisons against UK Air Quality Strategy Objectives are provided. The report also includes details of exceedances and periods of significant air pollution episodes in 2023. Long term trends in the pollutant concentrations from the KMAQMN are also presented and compared to data from the Automatic Urban and Rural Network (AURN).

2. KENT AND MEDWAY AIR QUALITY NETWORK

2.1 KENTAIR WEBSITE

The KentAir website (https://kentair.org.uk/) is a publicly accessible website that contains up to date information, data and resources relating to air quality in the region.

Pages on the site provide important information such as:

- Details on the key ambient pollutants, their sources and impacts on health.
- How the pollutants are monitored.
- The Daily Air Quality Index (DAQI) bands and how these can be used.
- Current legislation, policy, standards and objectives.

The front page includes an interactive map which displays the current DAQI for each monitoring site, and a postcode selector to allow users to zoom into specific locations. Information on the monitoring sites, including photos, reports and statistics is easily accessible via the map. Users can also sign up to air pollution forecasts via the website.

A tab on the front page links to the Care for Air website (https://care-for-air.kentair.org.uk), an educational resource which provides information about what causes pollution and how individuals can help to reduce it. Fact sheets and teaching materials can be downloaded, and an emissions calculator can be used to estimate an individual's emissions based on their travel choices.

2.2 AUTOMATIC MONITORING SITES

Seventeen automatic air quality monitoring sites were operational during 2023. Of these seventeen, three are part of the Automatic Urban and Rural Network (AURN).

A map of the locations of the monitoring sites is provided in Figure 1. Details of the pollutants measured at each site is shown in Table 2-1.

Figure 1 Automatic monitoring locations in the KMAQMN (blue circles) and UK national network (red circles).

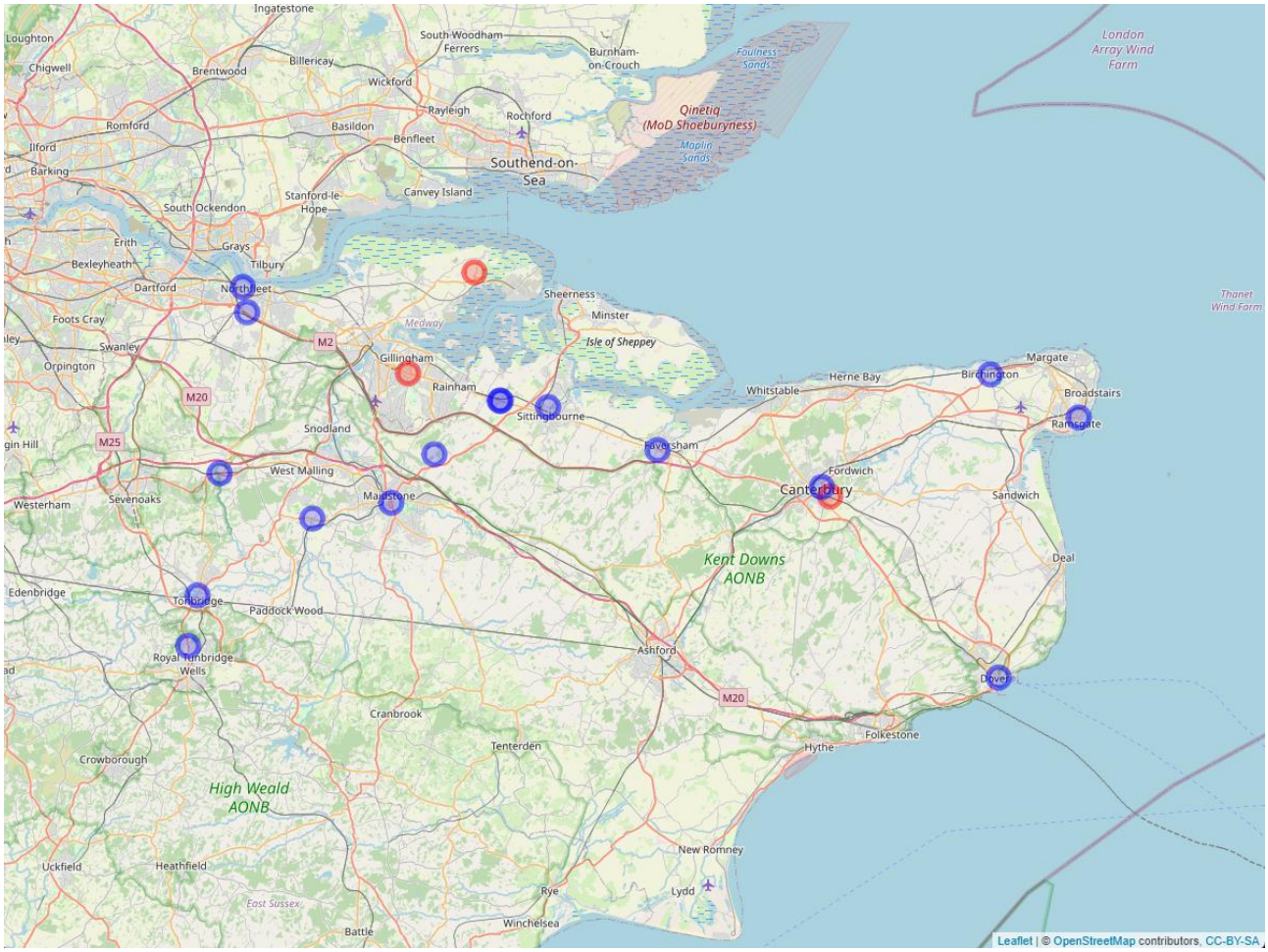


Table 2-1 Automatic monitoring stations within the KMAQMN during 2023

Site Name	Site Type	Network	Start	Pollutants Monitored
Canterbury	Urban background	AURN	02/01/2001	NO_2, O_3, PM_{10}, $PM_{2.5}$
Canterbury Military Road	Roadside	KMAQMN	01/10/2006	NO_2
Chatham Roadside	Urban traffic	AURN	01/07/2010	NO_2, PM_{10}, $PM_{2.5}$
Dover Centre Roadside	Roadside	KMAQMN	21/12/2000	PM_{10}
Gravesham A2 Roadside	Roadside	KMAQMN	31/12/1998	NO_2, PM_{10}
Gravesham Industrial Background	Urban background	KMAQMN	01/01/1999	NO_2, PM_{10}
Maidstone Rural	Rural	KMAQMN	01/01/1999	NO_2, PM_{10}
Maidstone Upper Stone Street	Roadside	KMAQMN	09/05/2018	NO_2, PM_{10}, $PM_{2.5}$
Rochester Stoke	Rural	AURN	26/01/1996	NO_2, O_3, PM_{10}, $PM_{2.5}$, SO_2

Site Name	Site Type	Network	Start	Pollutants Monitored
Swale Newington	Roadside	KMAQMN	07/04/2021	NO_2, PM_{10}, $PM_{2.5}$
Swale Ospringe Roadside 2	Roadside	KMAQMN	15/03/2006	NO_2
Swale St Pauls Street	Roadside	KMAQMN	21/01/2013	NO_2, PM_{10}, $PM_{2.5}$
Thanet Birchington Roadside	Roadside	KMAQMN	19/03/2007	NO_2, PM_{10}
Thanet Ramsgate Roadside	Roadside	KMAQMN	01/01/2003	NO_2, PM_{10}
Tonbridge High Street	Roadside	KMAQMN	14/07/2022	NO_2
Tonbridge and Malling, Borough Green Roadside	Roadside	KMAQMN	10/07/2005	NO_2, PM_{10}
Tunbridge Wells A26 Roadside	Roadside	KMAQMN	20/06/2005	NO_2, PM_{10}, $PM_{2.5}$

2.3 NETWORK CHANGES IN 2023

Particulate matter (PM_{10} and $PM_{2.5}$) is no longer monitored at Swale Ospringe Road 2 as of January 2023.

2.4 POLLUTANTS MONITORED

The KMAQMN monitors nitrogen dioxide (NO_2), particulate Matter (PM_{10} and $PM_{2.5}$), ozone (O_3) and sulphur dioxide (SO_2) at the automatic monitoring sites. Details of the sources and health impacts of each pollutant and methods for monitoring are provided below:

Nitrogen Dioxide: NO_2 is formed from combustion processes and has a primary (emitted directly) and secondary (formed from chemical reactions in the atmosphere) component. In urban areas road transport is the main source of ambient NO_2. NO_2 can have an adverse effect on human health through inflammation of the airways and can cause issues with the respiratory system, in particular to those with underlying conditions.

Particulate Matter: Particulate matter in the atmosphere has many sources in the UK including combustion and road vehicle emissions. Similarly to NO_2, PM can consist of both primary and secondary sources. Secondary PM can be formed in the atmosphere from precursors such as nitrogen oxides, sulphur dioxide and ammonia. PM can also be transported long distances, therefore increases in PM can often occur in the UK when pollution is transported from the continent. PM_{10} and $PM_{2.5}$ are monitored in the KMAQMN, these are particles that pass through a size-selective inlet with 50% efficiency at an aerodynamic diameter of 10 and 2.5 µm, respectively. The smaller particles are of particular concern to human health as they can penetrate deep into the lungs. PM can also cause inflammation of the airways and exacerbate symptoms in those with heart and lung diseases. Small particles may also carry surface absorbed carcinogenic compounds into the lungs.

Ozone: Ozone is a secondary pollutant which is formed in the atmosphere via reactions between its precursors - nitrogen oxides (NOx) and volatile organic compounds (VOCs) - in the presence of sunlight. Ozone and its precursors can travel long distances, therefore the ozone measured at one location, may have originated many miles away. Ozone reacts rapidly with nitrogen oxide (NO), therefore ozone levels are typically lower in urban areas, where NO emissions are higher as a result of emissions from vehicle exhausts. Ozone can cause irritation to the eyes and nose and inflammation to the airways at high concentrations.

Sulphur Dioxide: The main source of SO_2 is from the combustion of fuels which contain sulphur. Exposure to SO_2 can cause irritation and constriction of the airways and exacerbate symptoms in those with underlying respiratory issues. In the atmosphere, SO_2 and water vapour can mix and form acid rain, which can have a destructive effect on the ecosystem.

2.5 MONITORING METHODS

The LAQM Technical Guidance LAQM.TG(22)[1] provides information on the monitoring techniques that can be used to monitor ambient pollutants as part of a local air quality monitoring programme. The KMAQMN includes the following montioring methods:

- Continuous NO_2 is measured by the chemiluminescence technique, which is the standard reference method of measuring NO, NO_2 and NOx.
- PM_{10} is measured by either Tapered Element Oscillating Microbalance (TEOM), Beta Attenuation Monitoring (BAM) or a fine dust monitoring system (FIDAS). $PM_{2.5}$ is measured by BAM or FIDAS. Correction factors to the data are required for the TEOM and BAMs before comparisons to air quality standards, as described in the LAQM Technical Guidance LAQM.TG(22). PM_{10} data from the TEOMs are corrected using the volatile correction model (VCM)[2] developed by King's College. PM_{10} data from the BAM is corrected using a multiplication value of 0.833. No corrections are necessary for $PM_{2.5}$ data.
- Ozone is measured using the standard ultraviolet (UV) absorption technique.
- SO_2 is measured by the UV fluorescence technique.

Ambient NO_2 is also monitored in the KMAQMN by diffusion tubes. Diffusion tubes are a passive monitoring technique that provides "indicative" measurements of NO_2 for comparison against air quality objectives. The tubes are exposed over 4-5 weeks, approximately coinciding with monthly periods, and an annual mean calculated from the data. NO_2 diffusion tubes are known to have biases, when compared to chemiluminescence NO_2 measurements, therefore the annual means from the tubes are required to be bias corrected, using local or national correction factors. If there is less than 9 months of data in a calendar year, the annual means are also required to be annualised, using local data from nearby automatic monitoring stations.

3. AUTOMATIC MONITORING RESULTS

3.1 NETWORK DATA CAPTURE

Table 3-1 shows the data capture rates for each site and pollutant measured during 2023. The target annual data capture rate is 90%, however, those analysers with a data capture greater than 75% can still provide representative annual means. Analysers with a data capture rate below 75% are not representative of the full year.

Table 3-1 Data capture rates, 2023. Red values represent data capture rates < 90 %.

Site Name	NO_2	PM_{10}	$PM_{2.5}$	O_3	SO_2
Canterbury	86.2	95.0	95.0	94.7	
Canterbury Military Road	98.9				
Chatham Roadside	99.1	97.4	97.1		
Dover Centre Roadside		92.9			
Gravesham A2 Roadside	98.1	99.7			
Gravesham Industrial Background	98.5	94.9			
Maidstone Rural	97.4	86.5			

[1] https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf
[2] http://www.volatile-correction-model.info/

Site Name	NO_2	PM_{10}	$PM_{2.5}$	O_3	SO_2
Maidstone Upper Stone Street	99.5	99.3	98.7		
Rochester Stoke	97.1	98.5	98.5	95.8	79.7
Swale Newington 4	99.1	93.8	96.9		
Swale Ospringe Roadside 2	98.3	5.2(a)			
Swale St Pauls Street	95.4	96.3	95.6		
Thanet Birchington Roadside	95.5	94.8			
Thanet Ramsgate Roadside	99.7	98.8			
Tonbridge and Malling, Borough Green Roadside	82.1	98.7			
Tonbridge High Street	99.7				
Tunbridge Wells A26 Roadside	99.0	99.6	92.3		
Number of sites	**16**	**15**	**7**	**2**	**1**
Number of sites >= 90%	**14**	**13**	**7**	**2**	**0**

(a) Analyser decommissioned.

3.2 COMPARISON WITH AQS OBJECTIVES

Table 3-2 provides an overview of the Air Quality Strategy Objectives applicable to local authorities in England (objectives for some pollutants are different in Scotland). The UK air quality objectives were originally transposed into UK law from the European Commission Directive on Ambient Air Quality and Cleaner Air for Europe[3]. Since leaving the EU, the UK is no longer tied to the EU limits, however, current objectives in the UK are based on those stated in the Directive.

Table 3-2 Air Quality Strategy Objectives (applicable to local authorities in England).

Pollutant	Limit Value	Averaging Period
Nitrogen Dioxide (NO_2)	200 μgm^{-3} not to be exceeded more than 18 times a year	1-hour mean
	40 μgm^{-3}	Annual mean
Particulate Matter (PM_{10})	50 μgm^{-3} not to be exceeded more than 35 times a year	24-hour mean
	40 μgm^{-3}	Annual mean
Particulate Matter ($PM_{2.5}$)	20 μgm^{-3}	Annual mean
Sulphur dioxide (SO_2)	266 μgm^{-3} not to be exceeded more than 35 times a year	15-minute mean
	350 μgm^{-3} not to be exceeded more than 24 times a year	1-hour mean
	125 μgm^{-3} not to be exceeded more than 3 times a year	24-hour mean

[3] European Commission, "DIRECTIVE 2008/50/EC OF The European Parliament And Of The Council of 21 May 2008 On Ambient Air Quality And Cleaner Air For Europe," 2008. [Online]. Avalable: https://www.legislation.gov.uk/eudr/2008/50/contents.

Pollutant	Limit Value	Averaging Period
Ozone (O_3)	100 μgm^{-3} not to be exceeded more than 10 times a year	Daily maximum running 8-hour mean

Table 3-3 shows the annual mean concentrations for all pollutants measured in the network, at each site. One site, Maidstone Upper Stone Street, exceeded the annual mean limit value of 40 μgm^{-3} in 2023, with a value of 40.7 μgm^{-3}. No sites exceeded the PM_{10} annual mean limit value of 40 μgm^{-3}, or the $PM_{2.5}$ limit value of 20 μgm^{-3}.

Table 3-3 Annual mean concentrations, 2023. Values in red indicate those which exceed the relevant annual mean objective or target (applicable to NO_2, PM_{10} and $PM_{2.5}$ only)

Site Name	NO_2	PM_{10}	$PM_{2.5}$	O_3	SO_2
Canterbury	9.6	13.4	8.6	56.7	
Canterbury Military Road	18.4				
Chatham Roadside	17.5	15.4	10.1		
Dover Centre Roadside		21.5			
Gravesham A2 Roadside	19.5	11.7			
Gravesham Industrial Background	15.1	18.2			
Maidstone Rural	6.7	11.6			
Maidstone Upper Stone Street	40.7	17.2	11.8		
Rochester Stoke	9.0	14.8	9.7	57.3	0.7
Swale Newington 4	20.3	16.1	12.1		
Swale Ospringe Roadside 2	20.9	*			
Swale St Pauls Street	26.5	32.2	11.6		
Thanet Birchington Roadside	22.2	16.5			
Thanet Ramsgate Roadside	15.0	25.5			
Tonbridge and Malling, Borough Green Roadside	20.9	21.6			
Tonbridge High Street	24.7				
Tunbridge Wells A26 Roadside	23.4	19.9	7.4		

* Annual mean not calculated due to data capture <25%.

A comparison of 2023 data with short-term Air Quality Strategy Objectives is provided in Table 3-4. In 2023, the 24-hour mean PM_{10} objective was exceeded on 38 occasions at Swale St Pauls Street. This is greater than the 35 permitted exceedances of this AQS objective. Furthermore, there were 21 and 17 exceedances of the 8-hour running meaning objective for O_3 of 100 μgm^{-3} at Canterbury and Rochester Stoke respectively. This is greater than the 10 allowable exceedances of the O_3 8-hour running mean objective.

Table 3-4 Number of exceedances of short-term objectives in 2023. Values in red indicate those which exceed the relevant short-term mean objective more than the permitted number of times.

Site Name	NO_2	PM_{10}	O_3	SO_2		
	1-hour	24-hour	Daily max running 8-hour	24-hour	1-hour	15-minute
Canterbury	0	0	21			
Canterbury Military Road	0					
Chatham Roadside	0	0				
Gravesham A2 Roadside	0	0				
Gravesham Industrial Background	0	1				
Maidstone Rural	0	0				
Maidstone Upper Stone Street	0	0				
Rochester Stoke	0	6	17	0 (1.7)[b]	0 (4.0)[c]	0 (6.4)[d]
Swale Newington 4	0	0				
Swale Ospringe Roadside 2	0	0				
Swale St Pauls Street	0	38				
Thanet Birchington Roadside	0	1				
Thanet Ramsgate Roadside	0	6				
Tonbridge and Malling, Borough Green Roadside	0 (87.9)[a]	3				
Tonbridge High Street	0					
Tunbridge Wells A26 Roadside	0	0				

[a]Value in bracket represents the 99.8th percentile where the valid data capture for year is less than 85%.
[b]Value in bracket represents the 99.2nd percentile where the valid data capture for year is less than 85%.
[c]Value in bracket represents the 99.7th percentile where the valid data capture for year is less than 85%.
[d]Value in bracket represents the 99.9th percentile where the valid data capture for year is less than 85%.

3.3 DAILY AIR QUALITY INDEX (DAQI)

The Daily Air Quality Index (DAQI)[4] is used to provide information on air pollution levels and recommendations on the actions that can be taken depending on the index value. The index ranges from 1 to 10 and is sub categorised into 4 bands (Low, Moderate, High, Very High). The bands are based on recommendations from the Committee on the Medical Effects of Air Pollutants (COMEAP). An overview of the bands for O_3, NO_2, SO_2 $PM_{2.5}$ and PM_{10} is provided in Table 3-5.

[4] https://uk-air.defra.gov.uk/air-pollution/daqi?view=more-info

Table 3-5 Daily Air Quality Index (DAQI) bands for each pollutant.

Index	Band	Ozone 8-Hourly Mean (µgm^{-3})	Nitrogen Dioxide Hourly Mean (µgm^{-3})	Sulphur Dioxide 15 Minute Mean (µgm^{-3})	$PM_{2.5}$ Daily Mean (µgm^{-3})	PM_{10} Daily Mean (µgm^{-3})
1	Low	0-33	0-67	0-88	0-11	0-16
2	Low	34-66	68-134	89-177	12-23	17-33
3	Low	67-100	135-200	178-266	24-35	34-50
4	Moderate	101-120	201-267	267-354	36-41	51-58
5	Moderate	121-140	268-334	355-443	42-47	59-66
6	Moderate	141-160	335-400	444-532	48-53	67-75
7	High	161-187	401-467	533-710	54-58	76-83
8	High	188-213	468-534	711-887	59-64	84-91
9	High	214-240	535-600	888-1064	65-70	92-100
10	Very High	241 or more	601 or more	1065 or more	71 or more	101 or more

The overall DAQI for a specific site is calculated as the highest index from each the five different pollutants and actions and health advice provided for each of the bandings, as shown in Table 3-6.

Table 3-6 DAQI bandings and associated actions and health advice. Taken from https://uk-air.defra.gov.uk/air-pollution/daqi

Air Pollution Banding	Index Value	Accompanying health messages for at-risk individuals*	Accompanying health messages for the general population
Low	1-3	**Enjoy** your usual outdoor activities.	**Enjoy** your usual outdoor activities.
Moderate	4-6	Adults and children with lung problems, and adults with heart problems, **who experience symptoms**, should **consider reducing** strenuous physical activity, particularly outdoors.	**Enjoy** your usual outdoor activities.
High	7-9	Adults and children with lung problems, and adults with heart problems, should **reduce** strenuous physical exertion, particularly outdoors, and particularly if they experience symptoms. People with asthma may find they need to use their reliever	Anyone experiencing discomfort such as sore eyes, cough or sore throat should **consider reducing** activity, particularly outdoors.

Air Pollution Banding	Index Value	Accompanying health messages for at-risk individuals*	Accompanying health messages for the general population
		inhaler more often. Older people should also **reduce** physical exertion.	
Very High	10	Adults and children with lung problems, adults with heart problems, and older people, should **avoid** strenuous physical activity. People with asthma may find they need to use their reliever inhaler more often.	**Reduce** physical exertion, particularly outdoors, especially if you experience symptoms such as cough or sore throat.

*Adults and children with heart or lung problems are at greater risk of symptoms. Follow your doctor's usual advice about exercising and managing your condition. It is possible that very sensitive individuals may experience health effects even on Low air pollution days. Anyone experiencing symptoms should follow the guidance provided below.

Table 3-7 to Table 3-11 show the number of days when a Moderate or above DAQI was recorded at each monitoring site in 2023 for the different pollutants. The results for each pollutant are considered below.

NO_2: There were no instances of Moderate, High or Very High NO_2 concentrations recorded at any site in the network in 2023.

PM_{10}: 5 of the 15 monitoring stations recorded at least one day with Moderate or above DAQI for PM_{10}. Swale St Pauls Street observed the highest number of Moderate or above days for PM_{10}, recording 28 days in the Moderate band, 5 days in the High band and 1 days in the Very High band.

$PM_{2.5}$: 5 of the 7 sites monitoring $PM_{2.5}$ observed $PM_{2.5}$ in the Moderate band, no sites observed $PM_{2.5}$ in the High band in 2023.

O_3: Canterbury and Rochester Stoke observed 20 days and 16 days, respectively of Moderate O_3 concentrations. Canterbury also recorded 1 day in the High band.

SO_2: There were no days when the SO_2 concentrations measured at the Rochester Stoke site reached the Moderate or above band.

Further information on the days when Moderate or high pollution was observed is provided in Section 3.4.

Table 3-7 Numbers of days with "Moderate" or above NO_2 concentrations in 2023.

Site Name	Moderate	High	Very High
Canterbury	0	0	0
Canterbury Military Road	0	0	0
Chatham Roadside	0	0	0
Gravesham A2 Roadside	0	0	0
Gravesham Industrial Background	0	0	0
Maidstone Rural	0	0	0
Maidstone Upper Stone Street	0	0	0
Rochester Stoke	0	0	0

Site Name	Moderate	High	Very High
Swale Newington 4	0	0	0
Swale Ospringe Roadside 2	0	0	0
Swale St Pauls Street	0	0	0
Thanet Birchington Roadside	0	0	0
Thanet Ramsgate Roadside	0	0	0
Tonbridge and Malling, Borough Green Roadside	0	0	0
Tonbridge High Street	0	0	0
Tunbridge Wells A26 Roadside	0	0	0

Table 3-8 Numbers of days with "Moderate" or above PM_{10} concentrations in 2023.

Site Name	Moderate	High	Very High
Canterbury	0	0	0
Chatham Roadside	0	0	0
Dover Centre Roadside	0	0	0
Gravesham A2 Roadside	0	0	0
Gravesham Industrial Background	0	0	0
Maidstone Rural	0	0	0
Maidstone Upper Stone Street	0	0	0
Rochester Stoke	5	0	0
Swale Newington 4	0	0	0
Swale Ospringe Roadside 2[(a)]	0	0	0
Swale St Pauls Street	28	5	0
Thanet Birchington Roadside	0	1	0
Thanet Ramsgate Roadside	6	0	0
Tonbridge and Malling, Borough Green Roadside	3	0	0
Tunbridge Wells A26 Roadside	0	0	0

[(a)]Annual data capture < 75 %, therefore some pollution episodes may not have been recorded.

Table 3-9 Numbers of days with "Moderate" or above $PM_{2.5}$ concentrations in 2023.

Site Name	Moderate	High	Very High
Canterbury	1	0	0
Chatham Roadside	0	0	0
Maidstone Upper Stone Street	3	0	0

Site Name	Moderate	High	Very High
Rochester Stoke	7	0	0
Swale Newington 4	2	0	0
Swale St Pauls Street	4	0	0
Tunbridge Wells A26 Roadside	0	0	0

Table 3-10 Numbers of days with "Moderate" or above O_3 concentrations in 2023.

Site Name	Moderate	High	Very High
Canterbury	20	1	0
Rochester Stoke	16	0	0

Table 3-11 Numbers of days with "Moderate" or above SO_2 concentrations in 2023.

Site Name	Moderate	High	Very High
Rochester Stoke	0	0	0

3.4 SIGNIFICANT AIR POLLUTION EPISODES

Table 3-12 shows the days when at least one of the pollutants (NO_2, PM_{10}, $PM_{2.5}$, O_3 and SO_2) observed Moderate or higher pollution. Section 3.2 illustrates the limit values.

Table 3-12 Dates when one or more pollutants were in the moderate or higher band.

Date	NO_2 DAQI	PM_{10} DAQI	$PM_{2.5}$ DAQI	O_3 DAQI	SO_2 DAQI
22/01/2023	2	2	2	4	1
28/01/2023	2	3	4	2	1
06/02/2023	2	2	4	3	1
07/02/2023	2	2	4	3	1
08/02/2023	2	2	5	3	1
09/02/2023	2	2	3	5	1
13/02/2023	2	2	6	5	1
14/02/2023	2	2	6	5	1
15/02/2023	2	2	5	4	1
03/04/2023	2	3	5	1	1
04/04/2023	2	3	8	2	1
05/04/2023	2	3	10	3	1
14/04/2023	2	3	7	1	1
17/04/2023	2	3	5	2	1
19/04/2023	1	3	5	2	1

26/04/2023	2	3	6	2	1
27/04/2023	2	3	8	3	1
29/04/2023	1	4	3	2	1
03/05/2023	1	3	5	2	1
06/05/2023	1	3	8	2	1
07/05/2023	2	2	4	6	1
09/06/2023	1	4	4	2	1
10/06/2023	2	7	3	3	1
11/06/2023	2	6	3	3	1
12/06/2023	2	5	5	5	1
13/06/2023	2	5	3	2	1
14/06/2023	2	5	3	2	1
15/06/2023	2	5	3	2	1
16/06/2023	2	4	4	2	1
17/06/2023	2	4	3	2	1
25/06/2023	2	5	2	1	1
07/07/2023	2	4	4	2	1
08/07/2023	2	4	3	2	1
18/08/2023	1	3	5	3	1
04/09/2023	2	4	4	3	1
05/09/2023	2	4	5	3	1
06/09/2023	2	5	8	6	1
07/09/2023	3	6	7	6	1
08/09/2023	3	6	5	3	1
09/09/2023	2	6	5	4	1
10/09/2023	2	5	5	5	1
15/09/2023	2	4	3	2	1
27/09/2023	2	3	4	2	1
10/10/2023	2	3	4	2	1
11/10/2023	2	3	4	2	1
16/10/2023	2	2	4	2	1
15/12/2023	2	2	6	2	1
18/12/2023	2	3	5	1	1

3.4.1 Particulate Matter Episodes

During 2023 particulate matter episodes occurred at sites in the Kent region. The limit values that set the thresholds for episodes are described in Section 3.2. Figure 3 and Figure 4, show the daily mean PM_{10} and $PM_{2.5}$ concentrations for those sites that observed moderate or higher pollution during 2023.

Very High PM_{10} of 107 μgm^{-3} was recorded at Swale St Pauls Street on 5th April 2023, all other sites recorded Low pollution bandings on this day. Moderate and High pollution bandings were also recorded across a majority of the UK between 4th September to 10th September. This pollution episode was likely due to air masses imported from

the continent which contained high concentrations of particulate matter from urban, industrial, and agricultural sources.

Figure 2: Daily mean PM_{10} concentrations for sites that observed moderate or higher pollution during 2023.

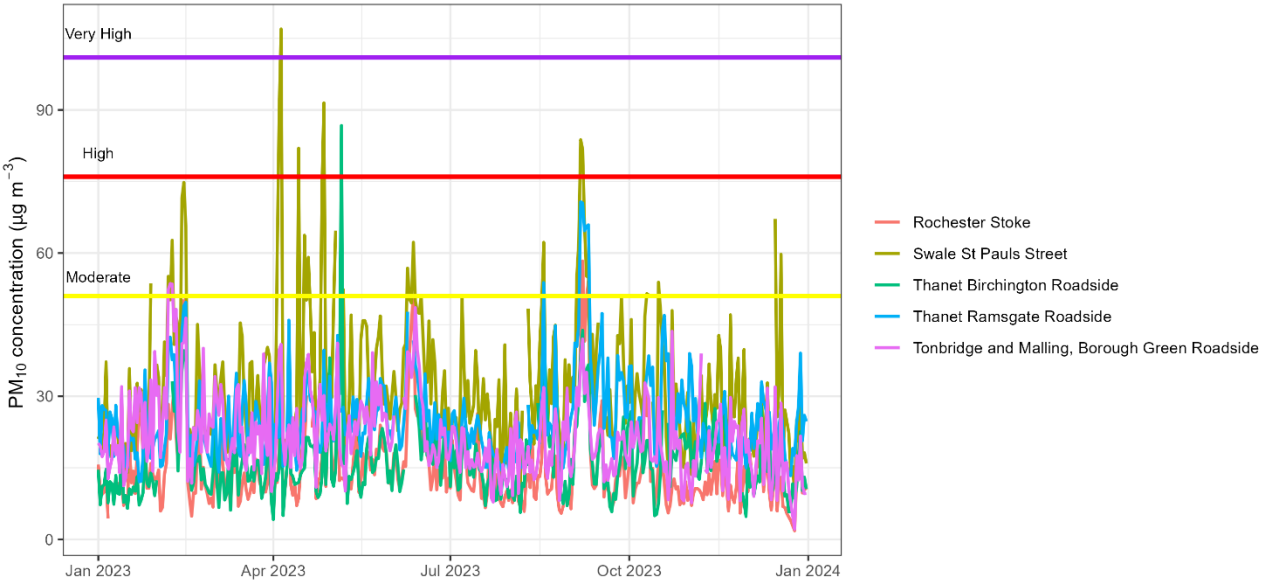
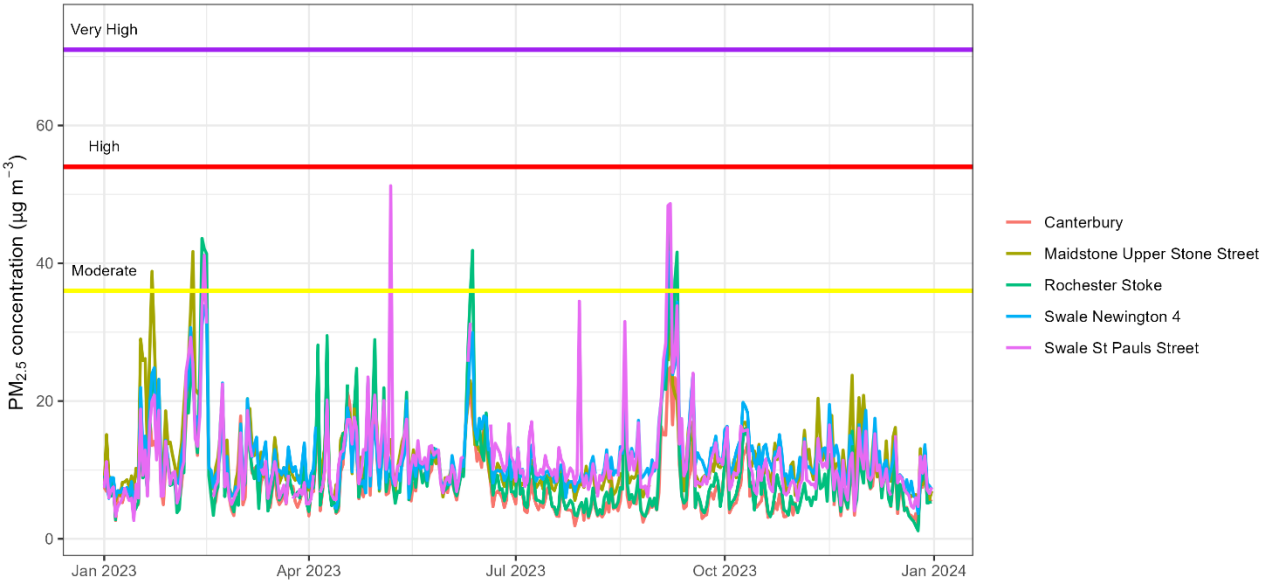


Figure 3: Daily mean $PM_{2.5}$ concentrations for that observed moderate or higher pollution during 2023.



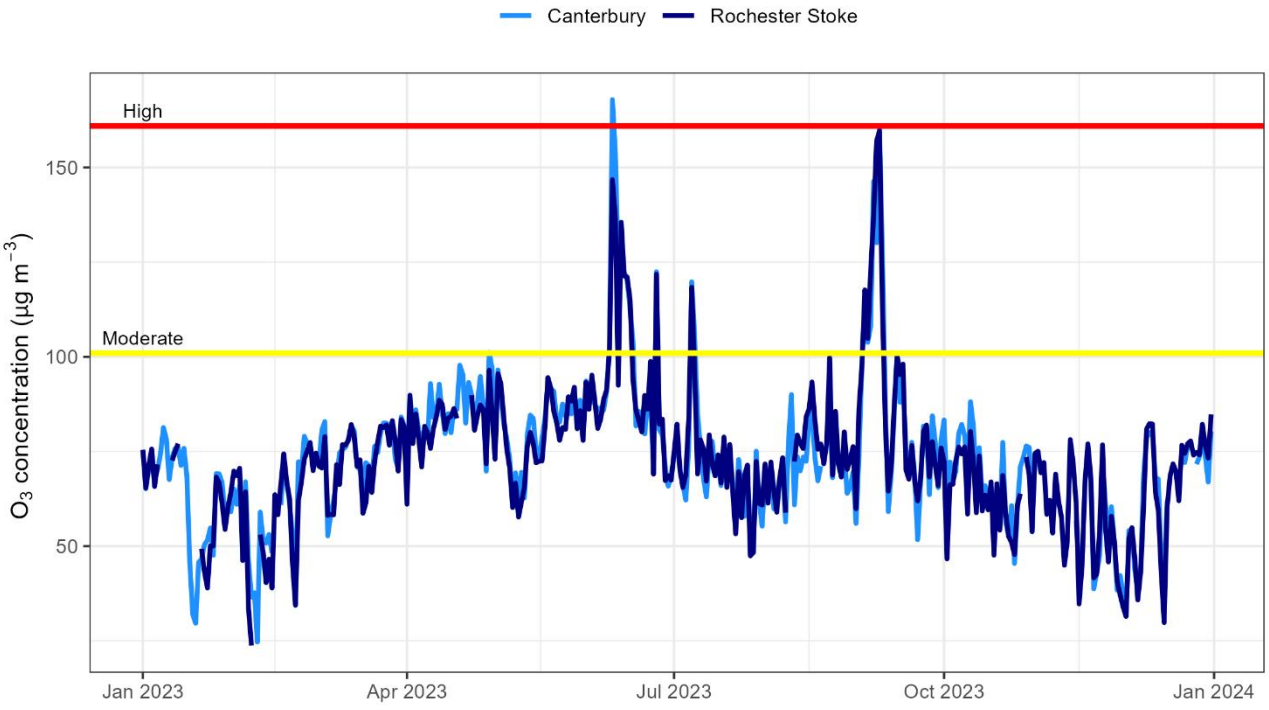
3.4.2 Ozone Episodes

Figure 5 shows the daily maximum 8-hour running mean ozone concentrations during 2023 for Canterbury and Rochester Stoke. The limit values that set the thresholds for episodes are described in Section 3.2.

In 2023, Moderate ozone occurred on 21 days and High ozone occurred on one day. The highest daily maximum 8-hour running mean for ozone was 168 μgm^{-3}, recorded at Canterbury on 6th June 2023. Ozone at Rochester on

the same day was also elevated at 147 μgm^{-3}. Ozone was also shown to peak at both Canterbury and Rochester stoke between 8th September and 9th September. This peak coincided with unusually high temperatures for September experienced across the UK. Moderate and High ozone were recorded across many areas of the UK between 4th September and 10th September.

Figure 4: Ozone maximum 8-hour running mean concentrations for each day during 2023 at Canterbury and Rochester Stoke.



As discussed in Section 2.4, ozone is formed in the atmosphere via reactions between NOx and VOCs under the presence of sunlight. Therefore, ozone pollution episodes typically occur during the spring and summer months, when the conditions are favourable for ozone production – warm temperatures, sunshine and stable conditions. Ozone can remain in the troposphere (lower part of the atmosphere) for many days and even weeks, so the ozone measured in one location may actually be formed much further downwind.

3.5 LONG TERM TRENDS

To assess the changes in pollutant concentrations over time, plots of the annual mean concentrations from 1998 to 2023 have been produced. The annual means for each pollutant and site are compared to the UK averages. For NO_2, PM_{10}, $PM_{2.5}$ and O_3 the UK average annual means are taken from the air quality statistics tables available from Defra[5]. SO_2 UK annual means have been calculated from the hourly SO_2 data, downloaded from UKAir[6]. All annual means are calculated for those years when the data capture rate is 75% or above.

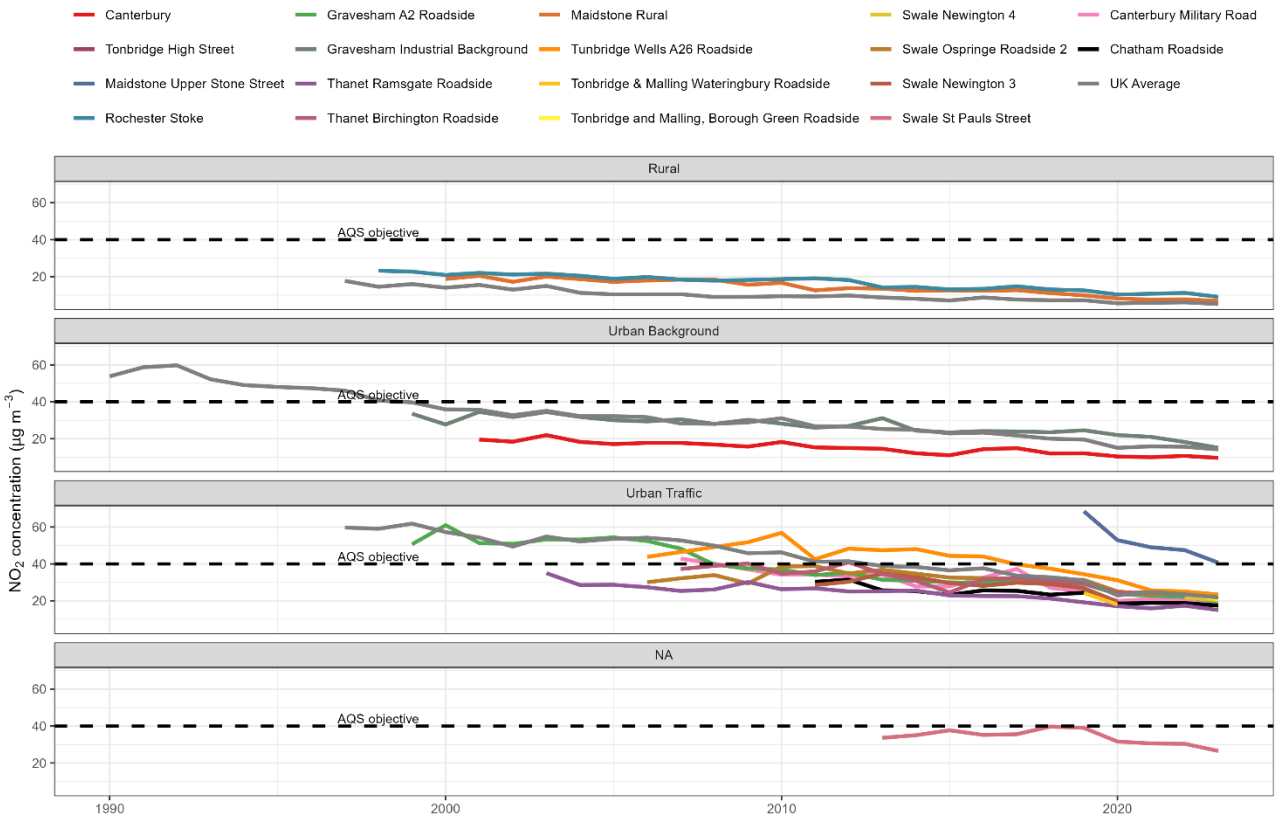
Figure 5 shows long term trends in NO_2 from rural, urban background and traffic monitoring stations in the KMAQMN along with UK averages from 1998 to 2023. NO_2 concentrations in general have decreased in the UK since the late 1990's, most likely due to a reduction in emissions as new Euro standard vehicles are introduced

[5] https://www.gov.uk/government/statistical-data-sets/env02-air-quality-statistics
[6] https://uk-air.defra.gov.uk/data/data_selector

into the fleet, and less coal used in energy generation. There is shown to be an overall decreasing trend in NO_2 concentrations across the KMAQMN, which follows the general trend observed in UK averages. Many sites saw a significant decrease in NO_2 concentrations in 2020, due to a reduction in traffic during the Covid-19 pandemic lockdowns. Since then, some sites have shown a small increase in NO_2 concentrations, however no sites have seen an increase in NO_2 concentrations above pre-covid pandemic levels.

Annual mean NO_2 concentrations at some sites in the KMAQMN are shown to be greater than the UK average. This is likely due to the great variability in NO_2 concentrations from site to site, depending on local sources. Location of sites and local traffic volumes can vary and can cause NO_2 concentrations at different sites to vary significantly, especially in urban areas where NO_2 emissions are primarily from road transport.

Figure 5: Trends in NO_2 annual means concentrations from rural, urban background and traffic monitoring stations in the KMAQMN, alongside the UK average from 1998 to 2023.



PM_{10} annual mean concentrations at urban background and traffic monitoring stations have shown a decrease since measurements began. Figure 6 shows this overall decreasing trend that follows the UK average. PM_{10} concentrations at Gravesham Industrial Background showed an increasing trend between 2015 and 2022. However, in 2023 PM_{10} concentrations measured at this monitoring location has shown a significant decrease compared to 2022. Annual PM_{10} concentrations measured at traffic monitoring sites are shown to be higher than the UK average, excluding Gravesham A2 Roadside and Tunbridge Wells A26 which are shown to be lower than the UK average. As the UK average includes all roadside stations in the UK, some of these may be located in areas which have much lower traffic volumes, and a lighter fleet composition thereby resulting in a lower annual mean concentration. PM_{10} concentrations can also vary significantly across sites due to the number of sources of this pollutant. Furthermore, in the South-East, there is an increase susceptibility to pollution transported from the continent under certain meteorological conditions due to the proximity to Europe.

Figure 6: Trends in PM_{10} annual means concentrations from urban background and traffic monitoring stations in the KMAQMN, alongside the UK average from 1998 to 2023.

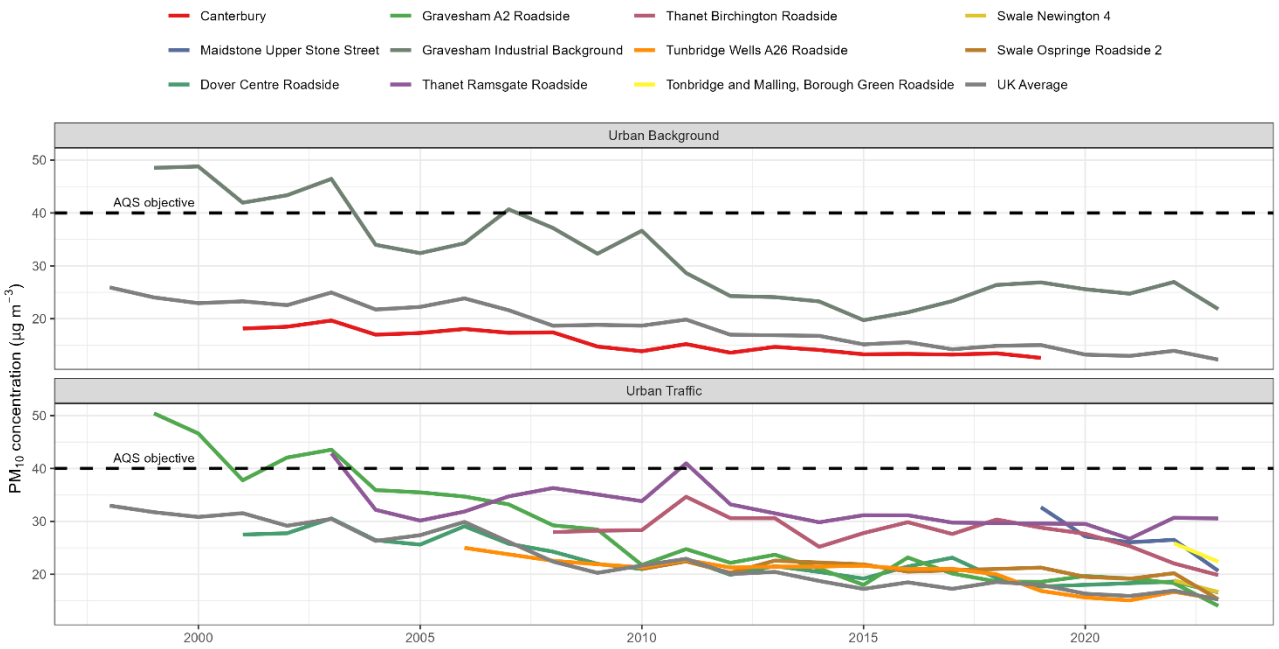
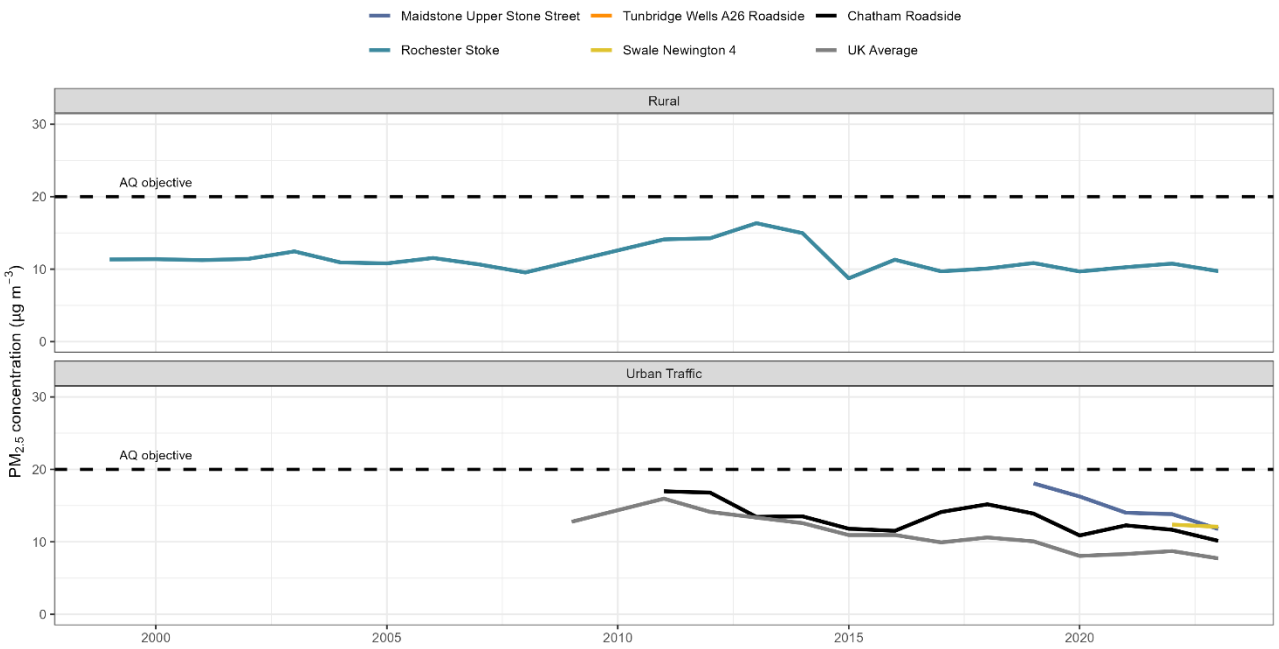


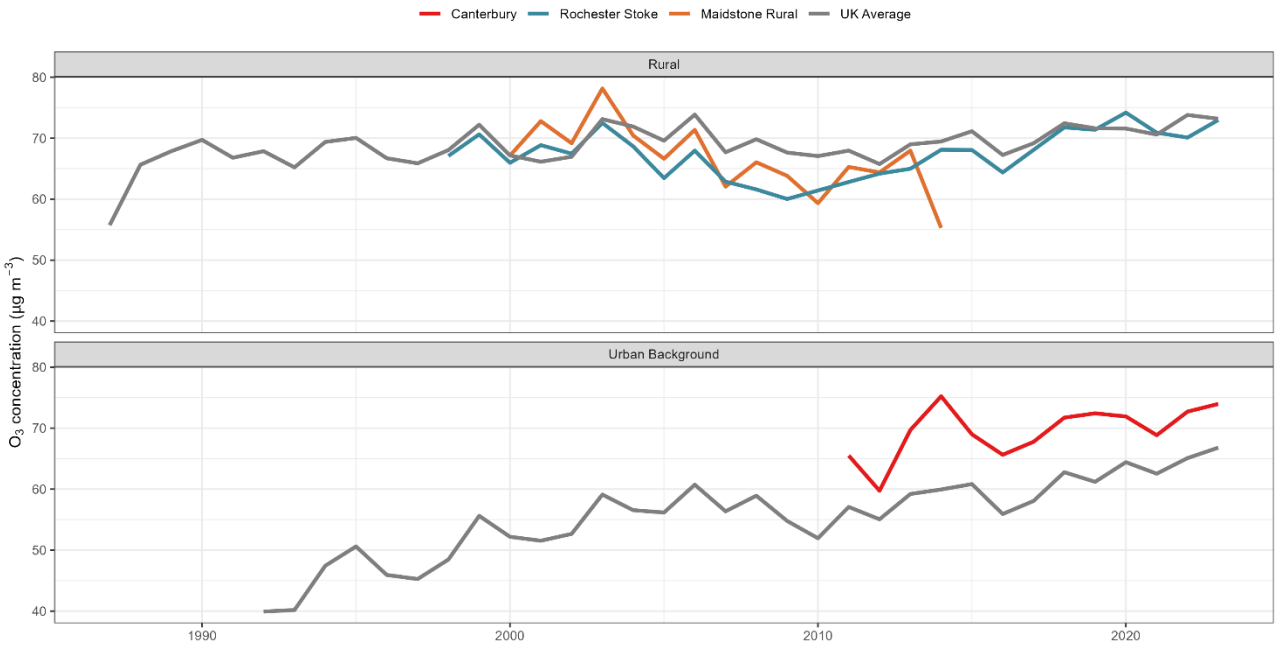
Figure 7 shows long term trends in $PM_{2.5}$ from rural and traffic monitoring stations in the KMAQMN. Note: there are no UK averages available for the rural monitoring sites, therefore a comparison with UK averages is only undertaken for the traffic monitoring sites. In 2023, annual mean $PM_{2.5}$ concentrations at the three traffic monitoring sites in the KMAQMN were shown to be higher than the UK annual average. However, all sites show a similar overall downward trend in concentrations to the UK annual average. $PM_{2.5}$ concentrations measured at Chatham Roadside increased between 2016 and 2018, followed by an overall decrease in concentrations.

Figure 7: Trends in $PM_{2.5}$ annual means concentrations from rural and traffic monitoring stations in the KMAQMN, alongside the UK average from 1998 to 2023.



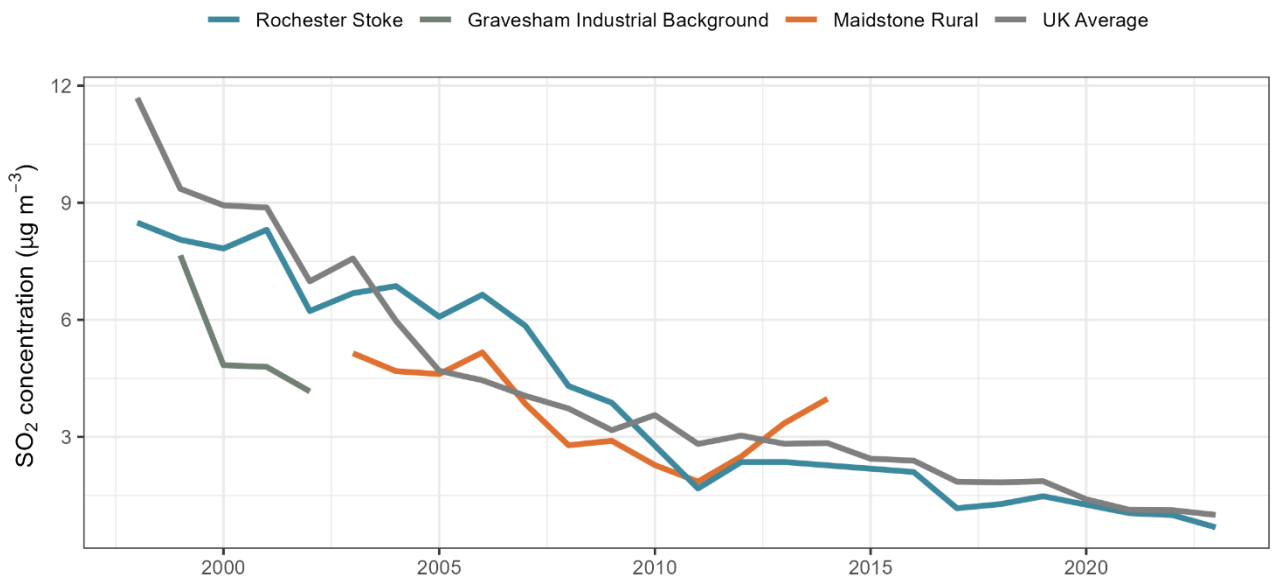
Ozone trends for rural and urban background monitoring stations are compared to the UK averages in Figure 8. The annual mean daily maximum running 8-hour mean ozone concentration is compared here, as this provides a better comparison of peak ozone concentrations year on year. In 2023, both sites monitoring ozone in the KMAQMN showed a small increase in concentrations in comparison to 2022 and an overall increasing trend since monitoring began at these sites. Ozone concentrations can vary greatly year on year as the formation of ozone is strongly dependant on meteorological conditions.

Figure 8: Trends in the annual mean of the daily maximum 8-hour mean O_3 concentrations from rural and urban background monitoring stations in the KMAQMN alongside the UK average from 1998 to 2023.



Sulphur dioxide concentrations have been shown to drastically reduce over the past few decades as a result of limitations put into place on the amount of sulphur in fuels and the reduction in power plants that use coal. Figure 9 shows SO_2 concentrations measured at Rochester Stoke have decreased between 2022 and 2023, and continue to closely follow the long-term decreasing trends seen in the UK average.

Figure 9: Trends in SO_2 annual means concentrations from the KMAQMN alongside the UK average from 1998 to 2023.



3.6 TEMPORAL VARIATION OF POLLUTANT CONCENTRATIONS

In this section temporal variations of the pollutant concentrations at each site are assessed using the openair R package 'timeVariation' function.

Figure 10 shows the daily, weekly, and monthly variations in NO_2 concentrations in 2023, for each of the monitoring stations. The plot shows diurnal trends in NO_2 concentrations at each site are similar, although vary in magnitude. Peaks in NO_2 are typically observed in the morning and evening at all monitoring sites in the KMAQMN and daily concentrations are lowest at the weekend. This indicates that road traffic is likely to be a prominent source of NO_2 at these monitoring locations.

The variations in ozone concentrations at the two sites are very similar, as shown in Figure 11. Both sites show peaks in ozone concentrations in the mid-afternoon. This is an expected daily trend as this is the period when photochemical production of ozone is greatest, and there is also less NO available to react with and remove ozone. At both sites, ozone concentrations are shown to peak in June. This is peak is expected as meteorological conditions are conducive to ozone formation.

Figure 10: Daily, weekly and monthly variation in NO_2 concentrations at each monitoring station for 2023.

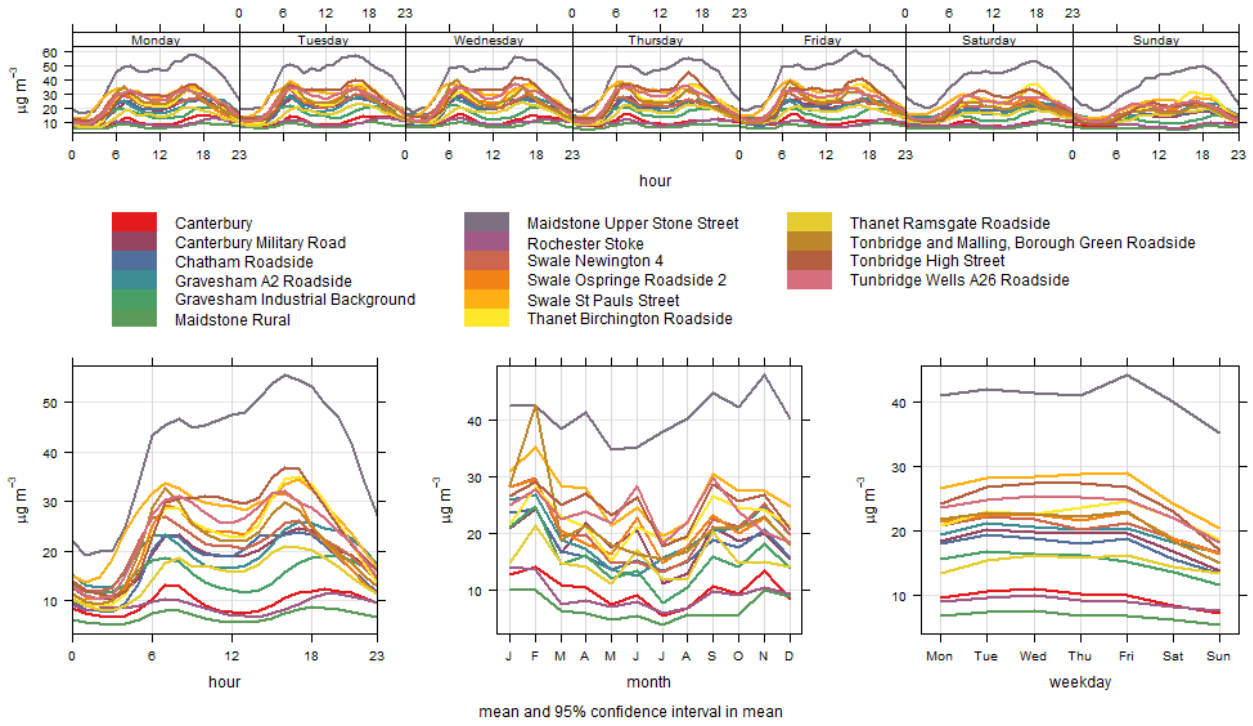


Figure 11: Daily, weekly and monthly variation in O_3 concentrations at each monitoring station for 2023.

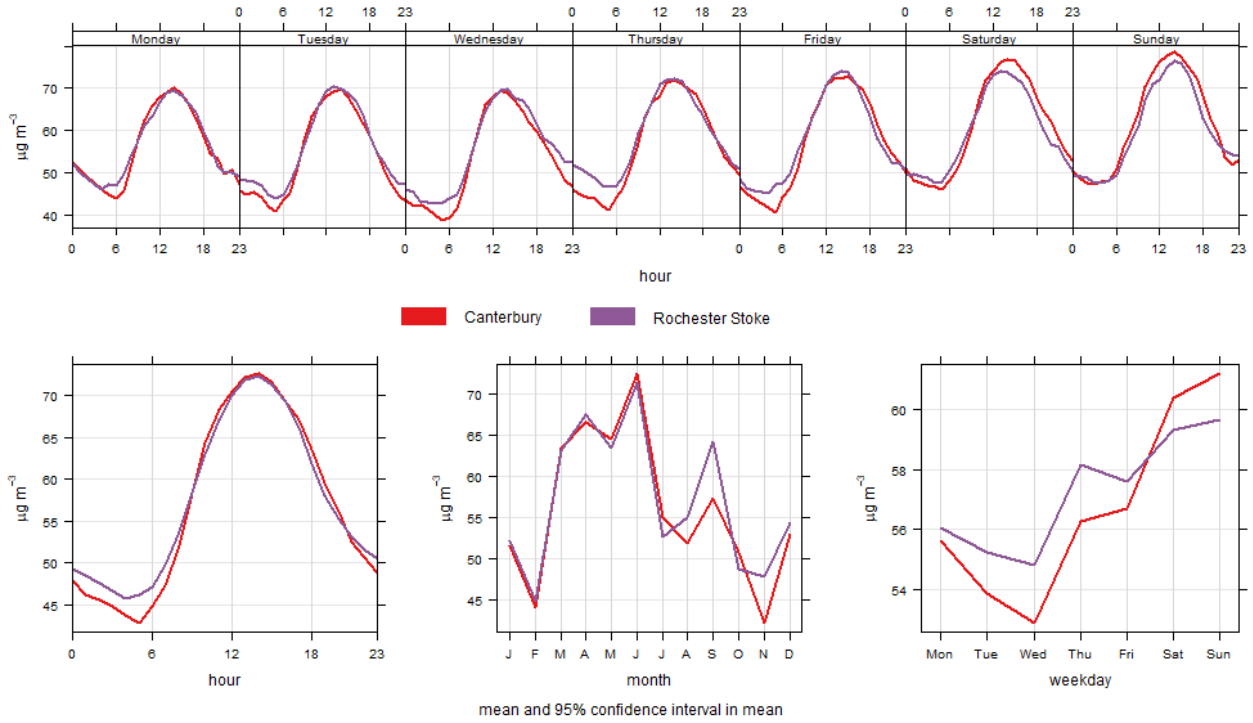


Figure 12 shows high variability in diurnal trends in PM_{10} concentrations at KMAQMN sites. Some sites show morning and afternoon peaks in PM_{10} concentrations, whereas other sites show concentrations remain elevated throughout the day. The morning peak in PM_{10} concentrations at Swale St Pauls Street is shown to be significantly higher than other monitoring sites, and concentrations remain elevated throughout the day which may indicate higher traffic flows around this site. Conversely, Figure 13 shows $PM_{2.5}$ concentrations show a similar diurnal trend at all sites, with broad peaks shown in the late evening.

Figure 12: Daily, weekly and monthly variation in PM_{10} concentrations at each monitoring station for 2023.

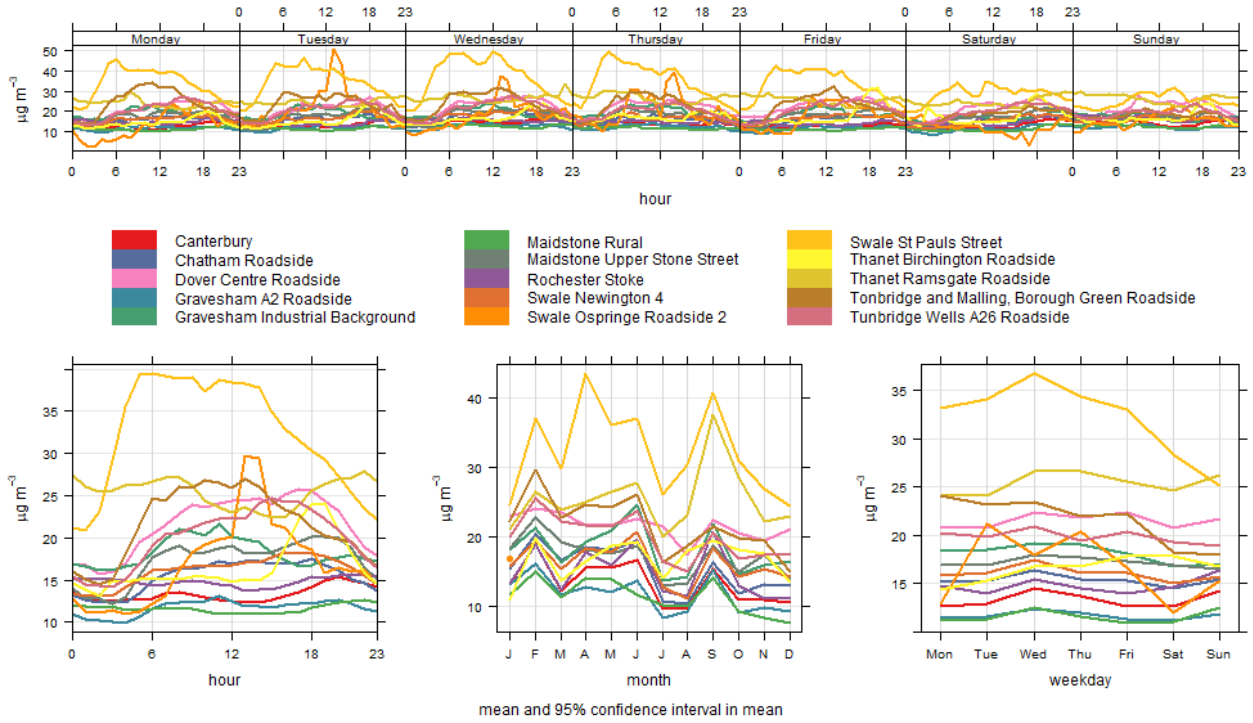
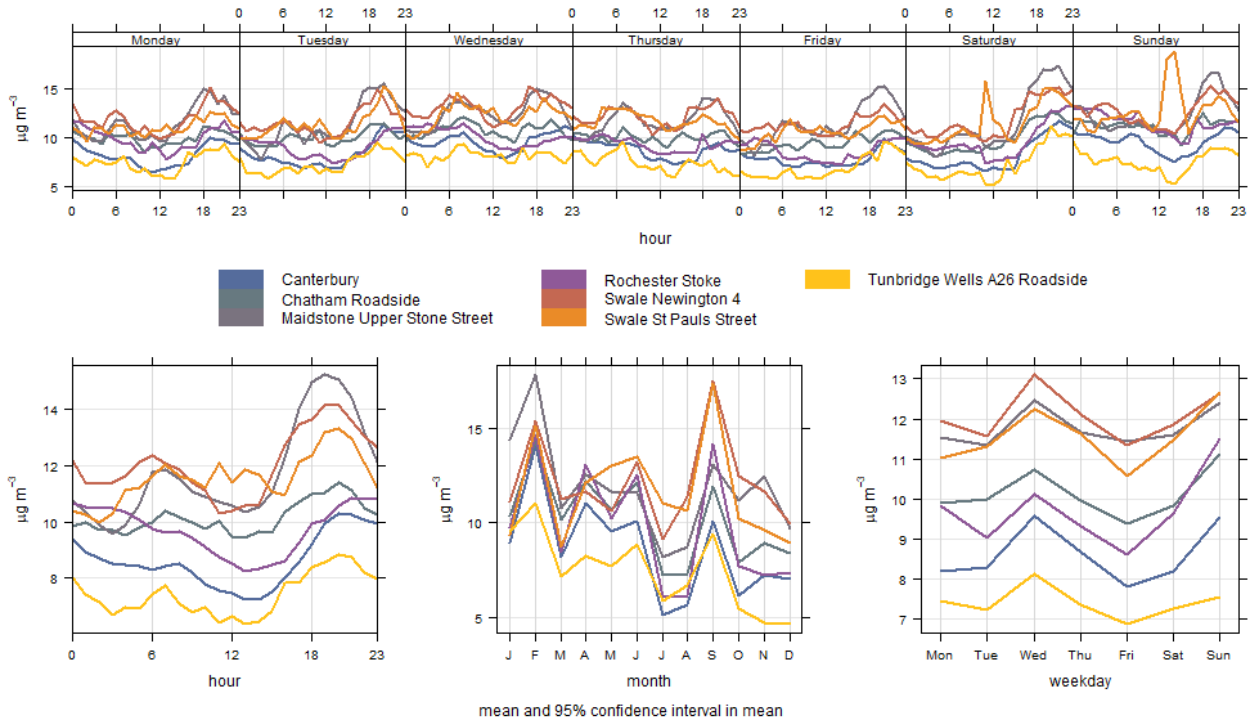


Figure 13: Daily, weekly and monthly variation in $PM_{2.5}$ concentrations at each monitoring station for 2023.



4. DIFFUSION TUBE MONITORING RESULTS

In addition to the automatic monitoring sites, the local authorities within the KMAQMN undertaken indicative measurements of Nitrogen dioxide using diffusion tubes. Diffusion tubes measure NO_2 via passive sampling. A reagent within the tube absorbs ambient NO_2 over a period of days or weeks. The tubes are then collected and analysed in a laboratory to determine the average concentration of NO_2 over the period the tube was exposed. As diffusion tubes are small and require no power, they can be easily attached to street furniture or façades of buildings. A network of these tubes can provide useful information on the spatial variation of NO_2 concentrations.

In this section a summary of the NO_2 diffusion tubes deployed in each local authority are presented for 2023. Table 4-1 shows the total number of sites operating during 2023, by each authority. At some locations, diffusion tubes are exposed in triplicate but are counted as one site here. Results and location information for each local authority's diffusion tube network are available through the KentAir website[7].

Table 4-1 NO_2 diffusion tube sites in Kent and Medway in 2023.

Local Authority	Number of Sites	Comments	Analytical Laboratory
Ashford Borough Council	27	1 triplicate location	Socotec (50% TEA in acetone)
Canterbury City Council	33	2 triplicate locations	Socotec (50% TEA in acetone)
Dover District Council	21	6 triplicate locations	Socotec (50% TEA in acetone)
Folkstone and Hythe District Council	18	-	Socotec (50% TEA in acetone)
Gravesham Borough Council	65	5 triplicate locations	Socotec (50% TEA in acetone)
Maidstone District Council	39	2 triplicate locations	Socotec (50% TEA in acetone)
Medway Council	52	-	Socotec (50% TEA in acetone)
Swale District Council	78	4 triplicate locations	Socotec (50% TEA in acetone)
Thanet District Council	43	3 triplicate locations	Socotec (50% TEA in acetone)
Tonbridge and Malling Borough Council	54	9 triplicate locations	Socotec (50% TEA in acetone)
Tunbridge Wells Borough Council	30	2 triplicate locations	Socotec (50% TEA in acetone)

[7] NO2 diffusion tube data - KentAir

4.1.1 Site classifications

NO_2 diffusion tubes sites are classified according to the site classifications stated in the Local Air Quality Management Technical Guidance LAQM (TG22)[8]

Table 4-2 Site classifications used for NO_2 diffusion tube sites.

Urban centre	An urban location representative of typical population exposure in towns or city centres, for example, pedestrian precincts and shopping areas
Urban background	An urban location distanced from sources and therefore broadly representative of citywide background conditions, e.g. urban residential areas
Suburban	A location type situated in a residential area on the outskirts of a town or city
Roadside	A site sampling typically within one to five metres of the kerb of a busy road (although distance can be up to 15 m from the kerb in some cases)
Kerbside	A site sampling within one metre of the kerb of a busy road
Industrial	An area where industrial sources make an important contribution to the total pollution burden
Rural	An open countryside location, in an area of low population
Other	Any special source-orientated or location category covering monitoring undertaken in relation to specific emission sources such as power stations, carparks, airports or tunnels

The majority of the NO_2 diffusion tube sites within the KMAQMN are classified as either kerbside or roadside, with a few urban background, suburban rural and industrial sites. It is not always the case that kerbside sites measure higher NO_2 concentrations than roadside sites, despite being located closer to the road edge, as it also depends on the volume of traffic on the road. Therefore, kerbside and roadside sites are considered together in this report under one category, “Urban Traffic”.

4.1.2 Bias adjustment, annualisation and fall-off with distance

NO_2 diffusion tubes provide a low-cost method of measuring ambient NO_2, however the method is not as precise or accurate as automatic NO_2 monitoring techniques, hence they can only be used for “indicative” measurements of NO_2. Diffusion tubes can also be affected by interferences which can result in positive or negative biases, when compared to automatic monitoring techniques. As such annual mean concentrations derived from the monthly NO_2 diffusion tube samples require to be “bias-corrected”.

Local bias correction factors may be determined by locating triplicate tubes next to an automatic analyser and calculating the ratio of the annual means from both methods. The calculated bias correction factor can then be used to correct the diffusion tube data for the local authority. If a local authority does not have an automatic monitoring station, national bias adjustment factors[9] may be used. National bias adjustment factors are based on co-location studies from many sites in the UK. A factor is calculated for each analysing laboratory, preparation method and year.

If a diffusion tube has between 3 and 8 months of data, then the data needs to be annualised to calculate the annual mean. Diffusion tubes with less than 3 months of data cannot be annualised. Annualisation is performed by comparing the data from diffusion tubes to nearby automatic monitoring stations. Further information on

[8] https://laqm.defra.gov.uk/wp-content/uploads/2022/08/LAQM-TG22-August-22-v1.0.pdf
[9] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/national-bias/

annualisation of diffusion tubes is provided in the Local Air Quality Management Technical Guidance LAQM (TG22).

Diffusion tubes are typically placed at locations of relevant exposure. However, this is not always possible, therefore, local authorities can use the NO_2 fall-off with distance calculator[10] to predict the annual mean concentration of NO_2 at the nearest relevant receptor.

4.1.3 Final annual means and comparison with AQ objectives for each LA

In this section bias-adjusted and annualised (where relevant) diffusion tube NO_2 annual mean concentrations for each local authority are shown, along with the AQS objective of 40 μgm^{-3}. The data is taken directly from each local authority's published annual status report located on the KentAir website here: https://kentair.org.uk/reports.

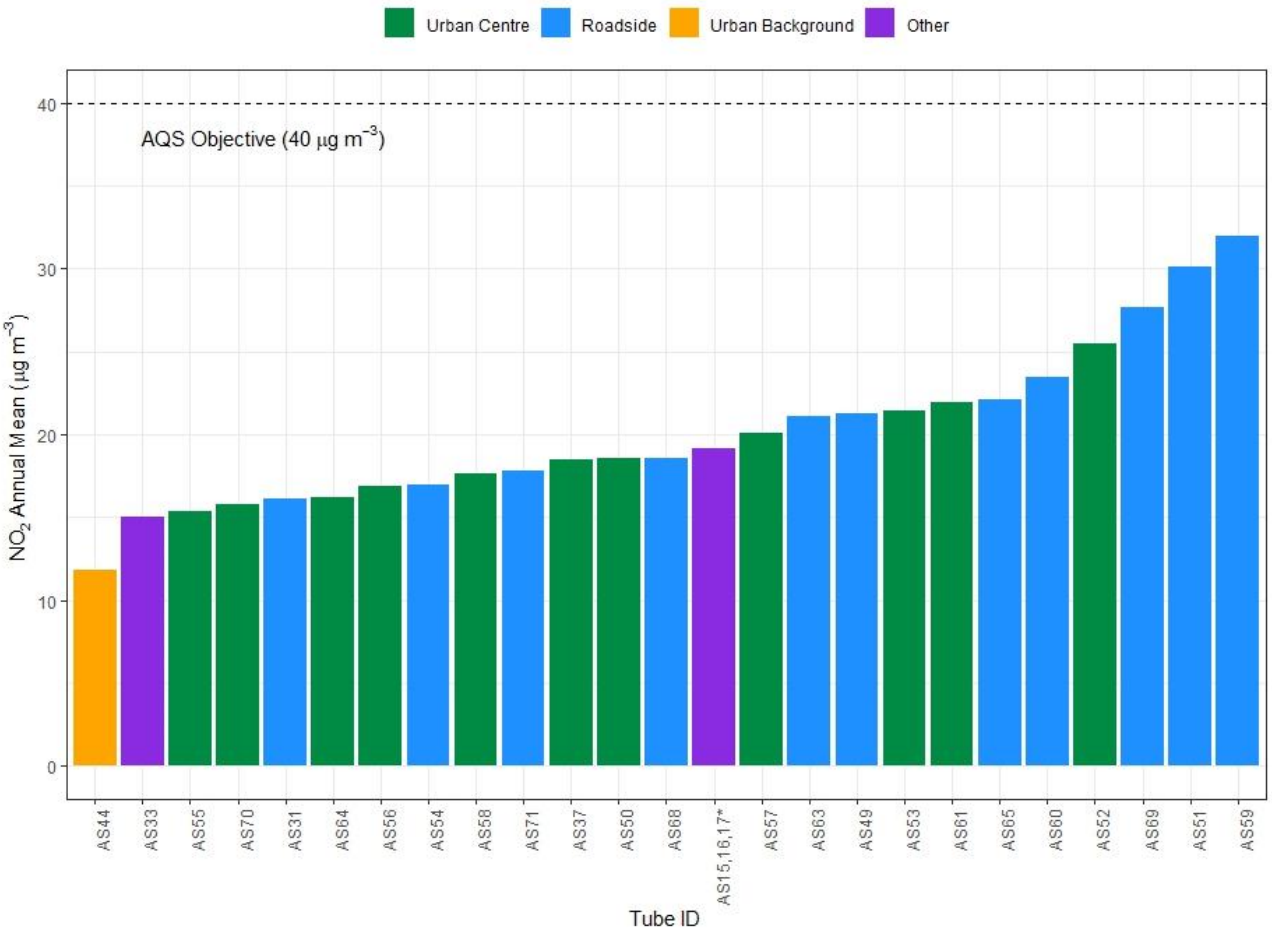
As diffusion tubes with less than 3 months of data cannot be annualised, the annual means for these tubes are not shown here. Sites with triplicate tubes are given by an asterisk (*), and a single value for the site shown, if this is how it is presented in the ASR. Please note that NO_2 concentrations presented in Figure 14 to Figure 24 are not corrected for fall-off with distance (where relevant) and represent the concentrations measured at the tube location, rather than the nearest relevant receptor.

[10] https://laqm.defra.gov.uk/air-quality/air-quality-assessment/no2-falloff/

4.1.3.1 *Ashford Borough Council*

In Ashford Borough NO_2 annual mean concentrations were measured at 25 diffusion tube sites in 2023. Of these, 11 sites were classified as Roadside, 1 as Urban Background, 11 as Urban Centre and 2 as Other (Other are located near motorways). Annual mean concentrations at all sites were below the AQS objective in 2023. The highest annual mean recorded at a diffusion tube site was 32.0 μgm^{-3}, recorded at the site on Romney Marsh Road (AS59).

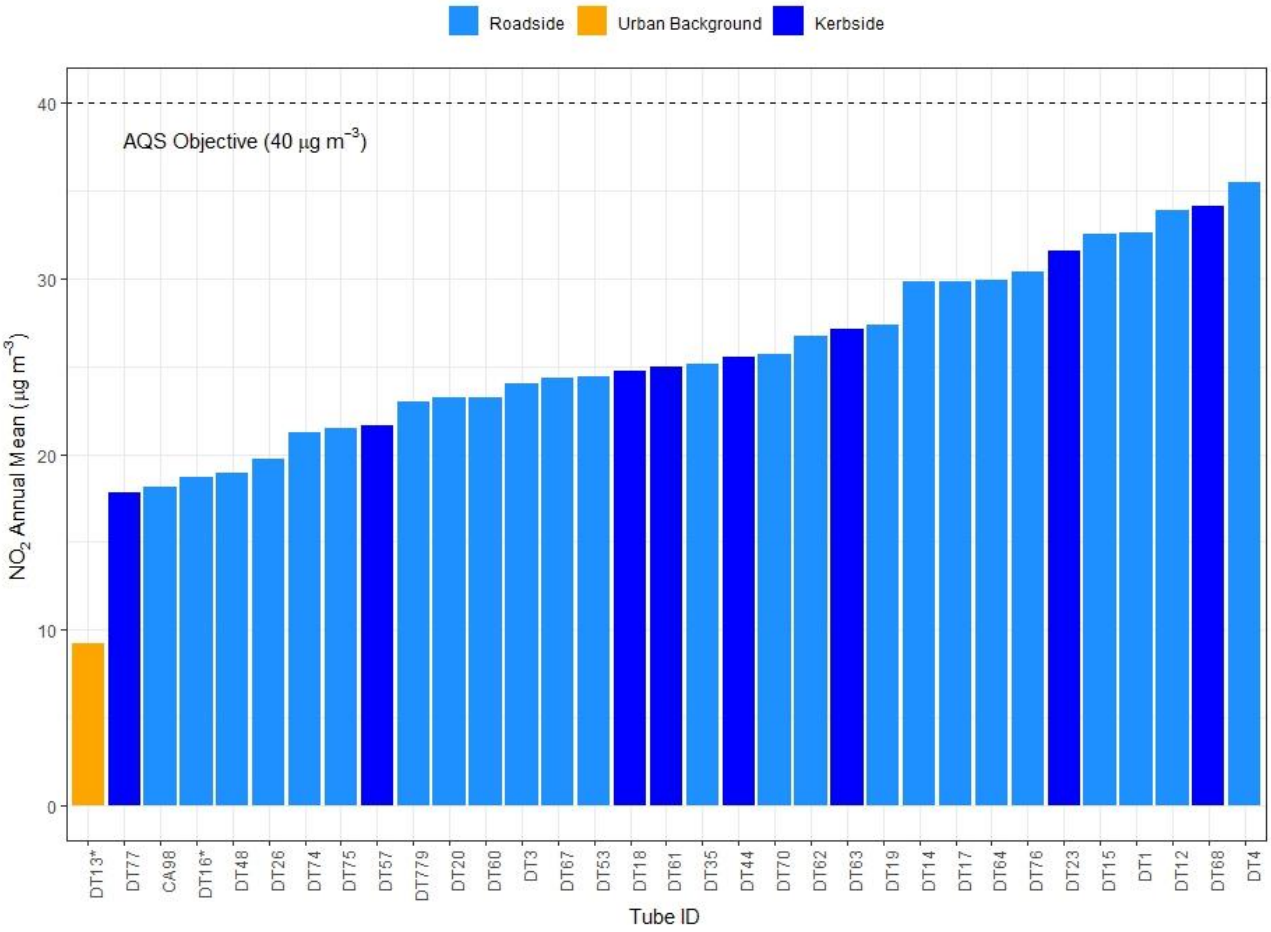
Figure 14 Ashford Borough Council diffusion tube NO_2 annual means for 2023.



4.1.3.2 *Canterbury City Council*

In Canterbury NO_2 annual mean concentrations were measured at 33 diffusion tube sites in 2023. Of these, 24 sites are classified as Roadside, 8 sites as Kerbside, and 1 as Urban Background. Annual mean concentrations at all sites, were below the AQS objective in 2023. The highest annual mean NO_2 concentration recorded at a diffusion tube site was 35.5 μgm^{-3} recorded at the site on Old Tannery Reims Way (DT4).

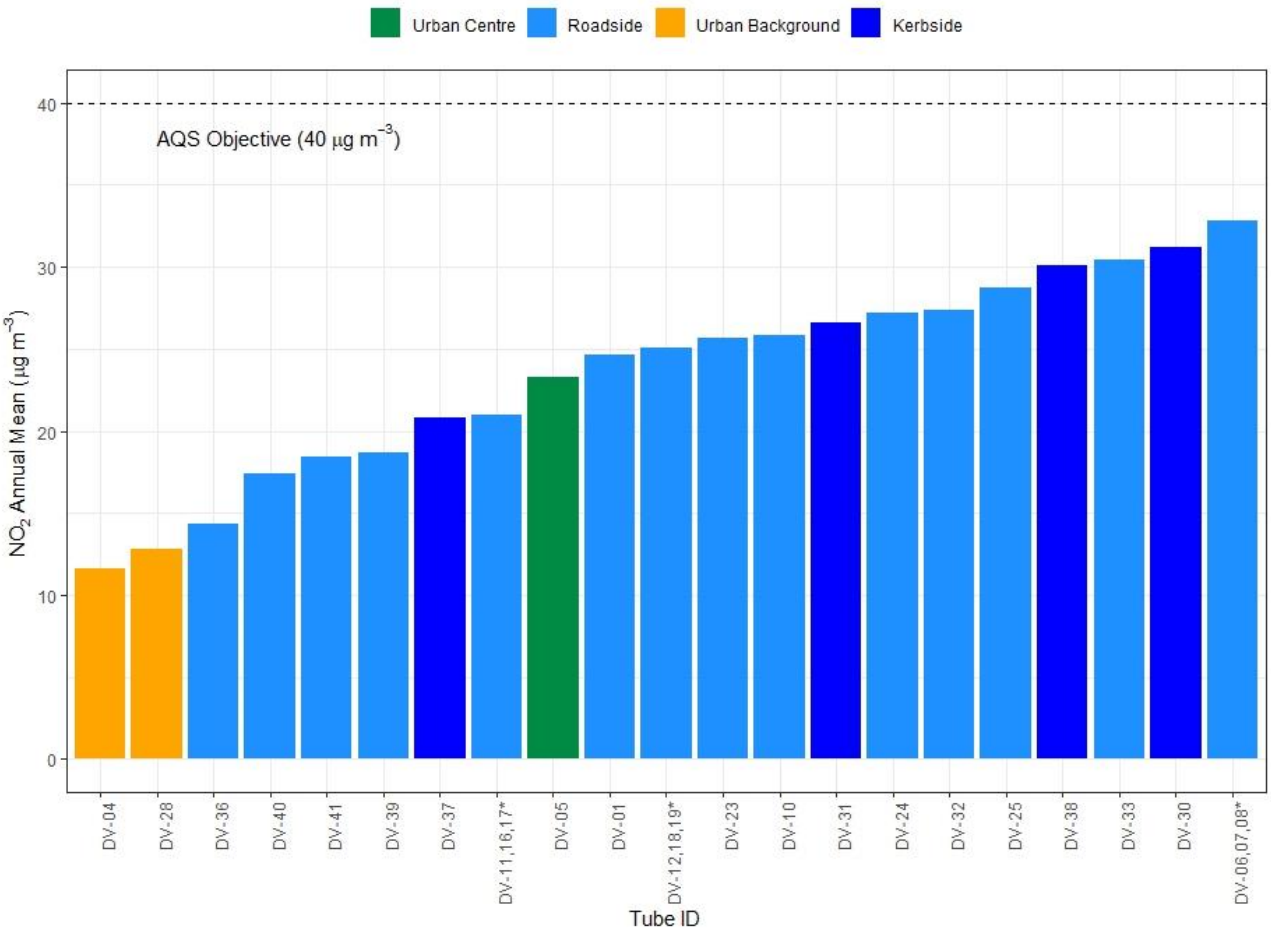
Figure 15 Canterbury City Council diffusion tube NO_2 annual means for 2023.



4.1.3.3 *Dover District Council*

In Dover NO_2 annual mean concentrations were measured at 21 diffusion tube sites in 2023. Of these, 14 sites are classified as Roadside, 2 as Urban Background, 1 as Urban Centre, and 1 as Rural. Annual mean concentrations at all sites were below the AQS objective in 2023. The highest annual mean NO_2 concentration recorded was 32.8 μgm^{-3} recorded at the diffusion tube triplicate site at Dover Town Hall (DV-06, DV07, and DV-08).

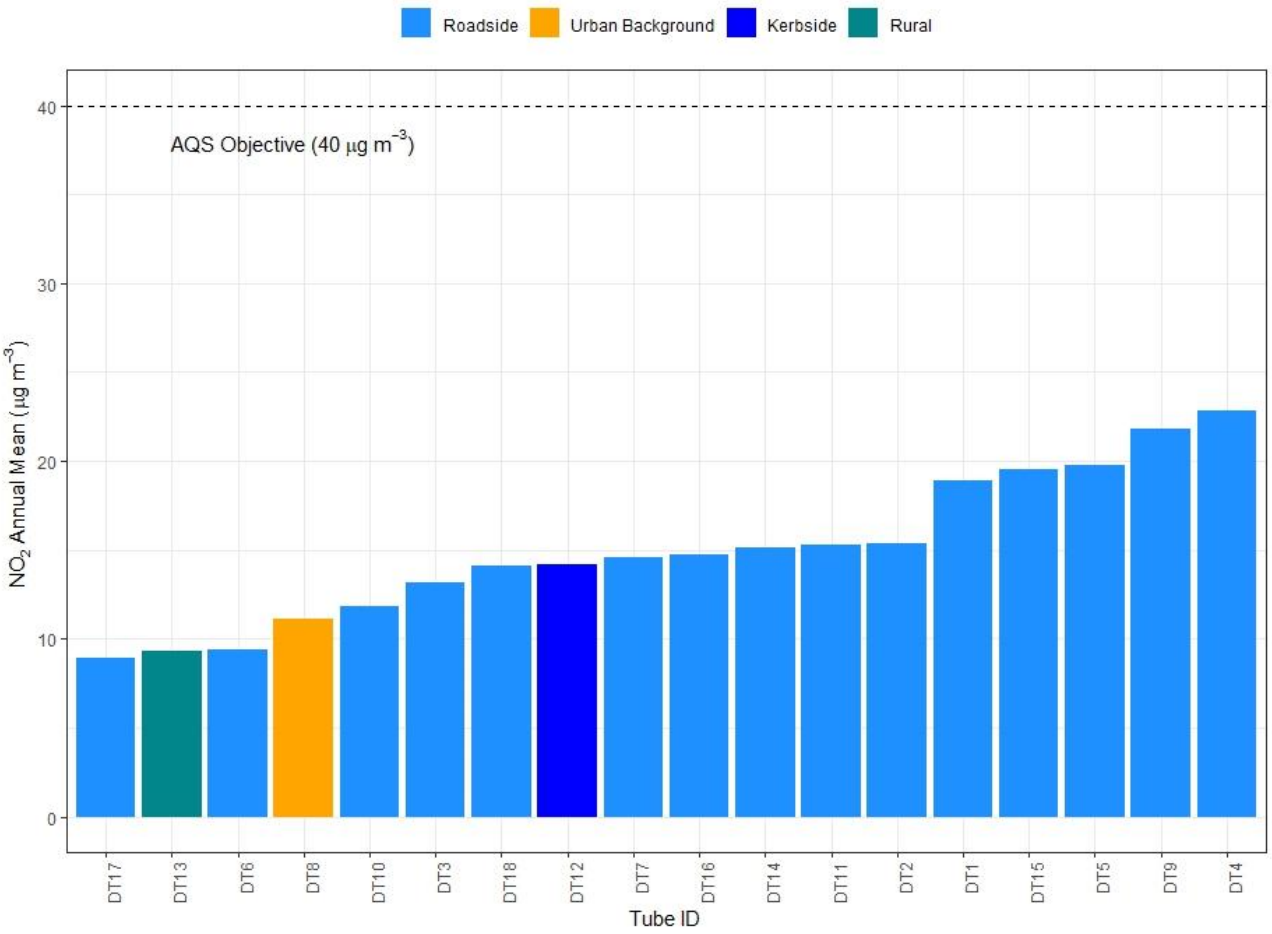
Figure 16 Dover District Council diffusion tube NO_2 annual means for 2023.



4.1.3.4 *Folkstone and Hythe District Council*

In Folkestone and Hythe NO_2 annual mean concentrations were measured at 18 diffusion tube sites in 2023. Of these, 15 site is classified as Roadside, 1 as Kerbside, 1 as Rural, and 1 as Urban Background. Annual mean concentrations at all sites were below the AQS objective in 2023. The highest annual mean recorded at a diffusion tube site was 22.8 μgm^{-3}, recorded at the site on Black Bull Road (DT4).

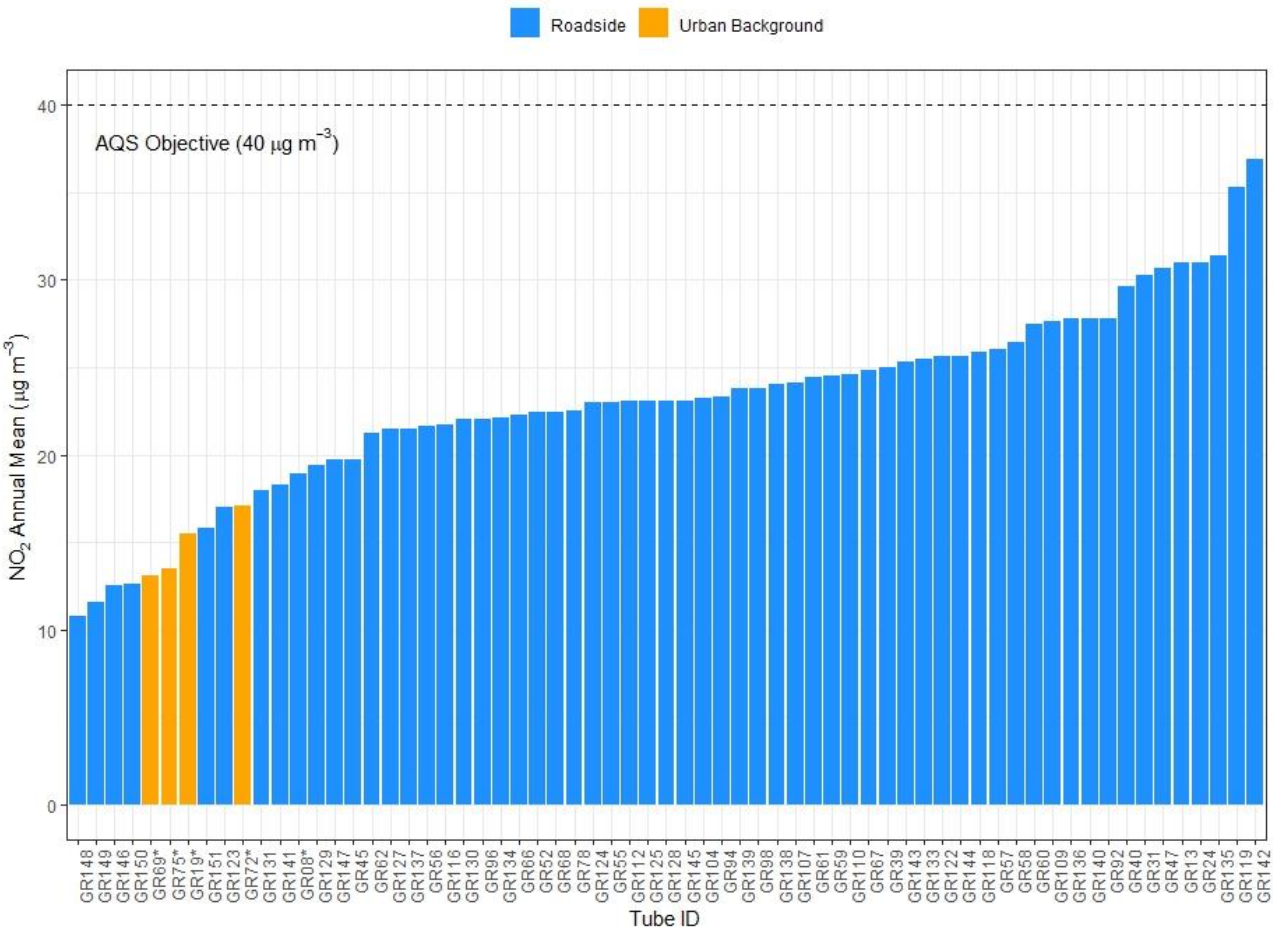
Figure 17 Folkstone and Hythe District Council diffusion tube NO_2 annual means for 2023.



4.1.3.5 *Gravesham Borough Council*

In Gravesham, NO_2 annual mean concentrations were measured at 65 diffusion tube sites in 2023. Of these, 61 sites are classified as Roadside, and 4 as Background. One site (GR142) recorded annual mean NO_2 concentrations of 36.9 µgm^{-3}, which was within 10% of the AQS objective. All other diffusion tube sites recorded annual mean NO_2 concentrations below the AQS objective.

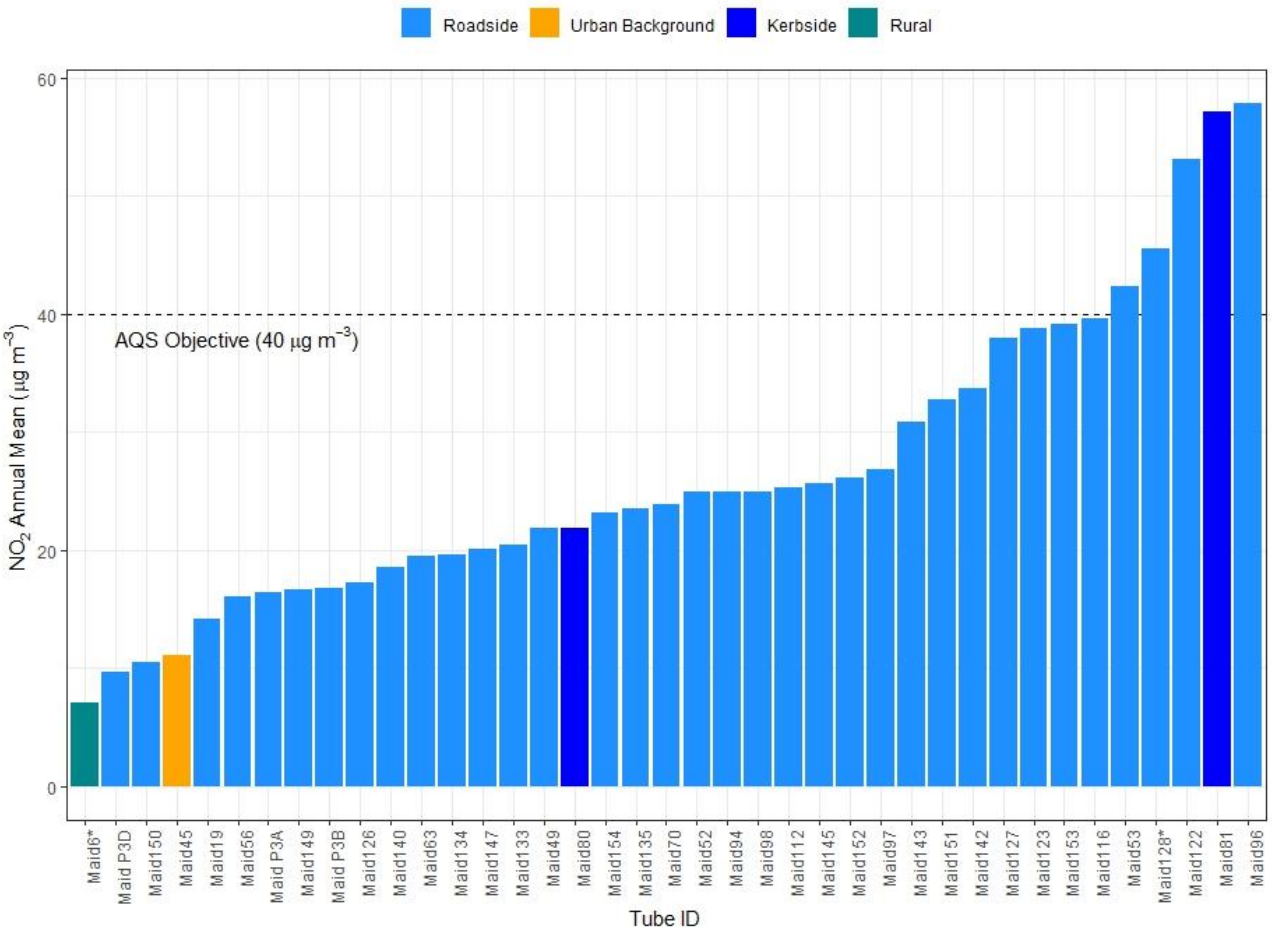
Figure 18 Gravesham Borough Council diffusion tube NO_2 annual means for 2023.



4.1.3.6 *Maidstone Borough Council*

In Maidstone, NO_2 annual mean concentrations were measured at 39 diffusion tube sites in 2023. Of these, 35 sites are classified as Roadside, 2 as Kerbside, 1 as Background and 1 as Rural. Five sites (Maid 53, Maid 81, Maid 96, Maid 122 and Maid 128) recorded annual mean NO_2 concentrations above the AQS objective in 2023. A further four sites were within 10% of the AQS objective (Maid 116, Maid 123, Maid 127, and Maid 153).

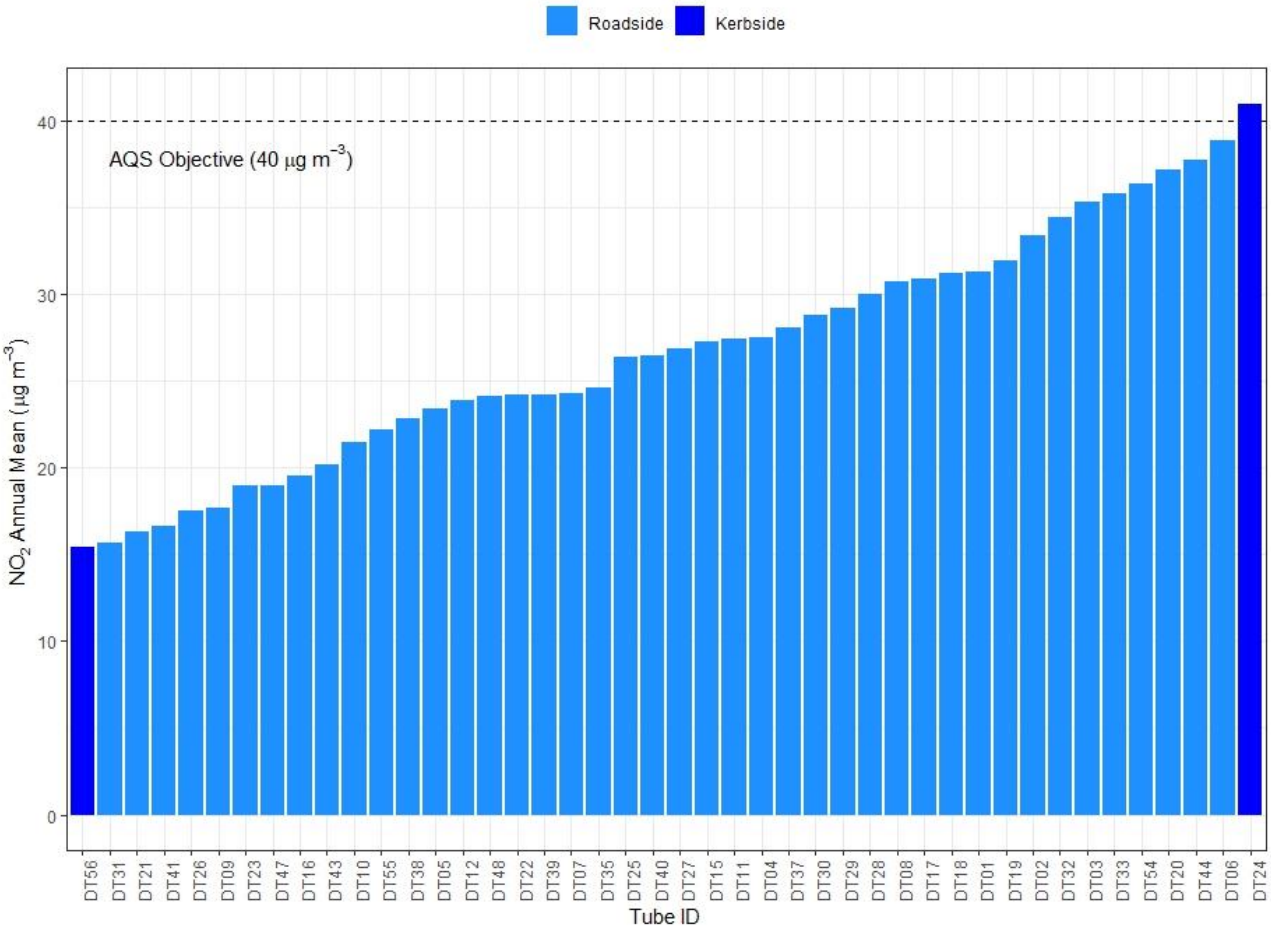
Figure 19 Maidstone District Council diffusion tube NO_2 annual means for 2023.



4.1.3.7 *Medway Council*

NO_2 annual mean concentrations were measured at 52 diffusion tube sites in 2023 by Medway Council. Of these, 49 sites are classified as Roadside and 3 as Kerbside. Data capture at eight of these sites were below 25% and therefore annual concentrations could not be reported. One diffusion tube site (DT24) recorded an annual mean NO_2 concentrations above the AQS objective in 2023. A further four sites were within 10% of the AQS objective (DT06, DT20, DT44, and DT56).

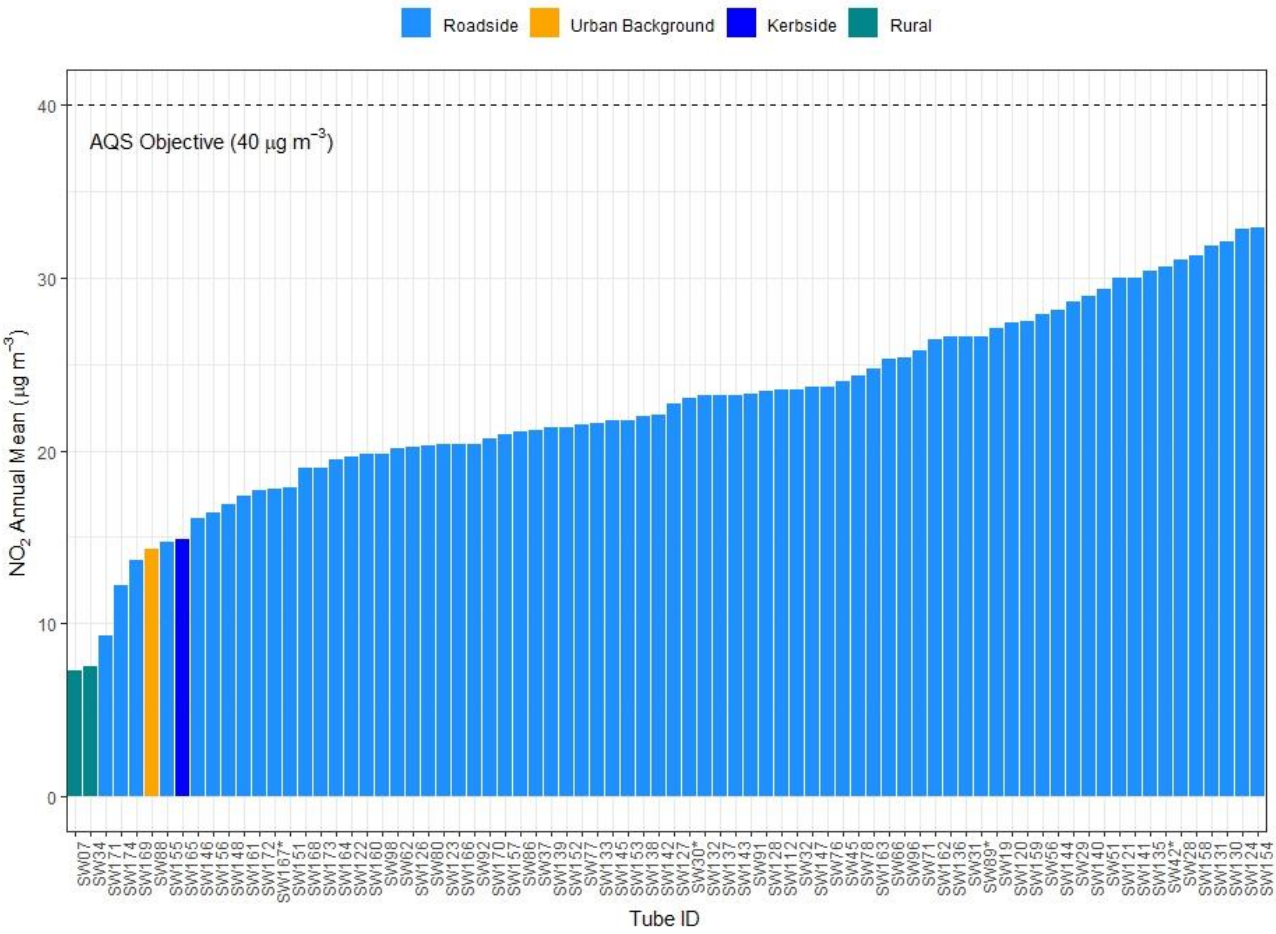
Figure 20 Medway Council diffusion tube NO_2 annual means for 2023.



4.1.3.8 *Swale Borough Council*

In Swale NO_2 annual mean concentrations were measured at 78 diffusion tube sites in 2023. Of these,74 sites are classified as Roadside, 2 as Rural, 1 as Kerbside and 1 as Urban Background. Annual mean NO_2 concentrations at all sites were below the AQS objective in 2023. The highest annual mean NO_2 concentration was 32.9 μgm^{-3} recorded at a diffusion tube site located on Keycol Hill, Sittingbourne (SW154).

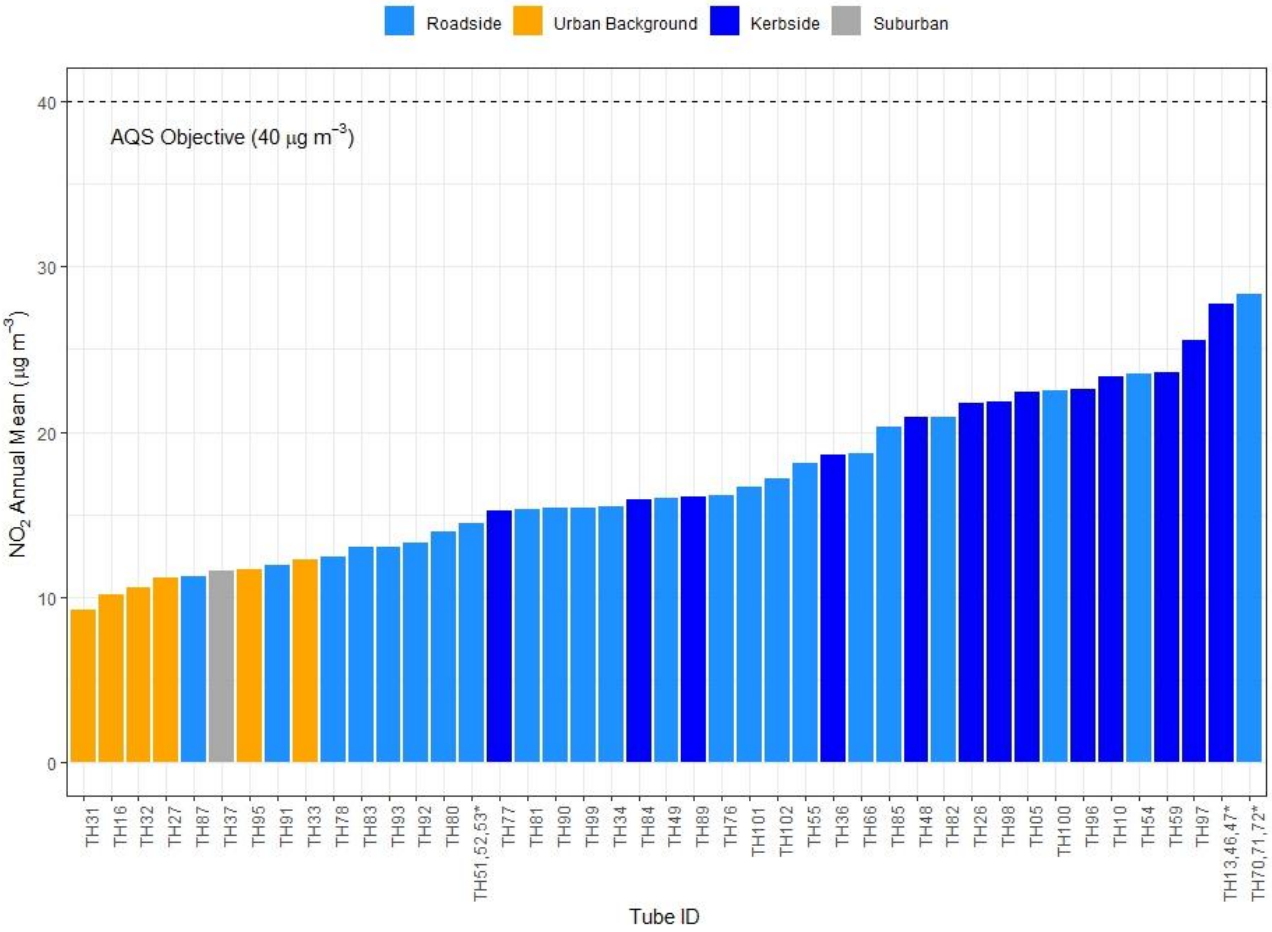
Figure 21 Swale District Council diffusion tube NO_2 annual means for 2023.



4.1.3.9 *Thanet District Council*

In Thanet, NO_2 annual mean concentrations were measured at 43 diffusion tube sites in 2023. Of these, 23 sites are classified as Roadside, 13 sites as Kerbside, and 1 as Suburban. Annual mean concentrations at all sites were below the AQS objective in 2023. The highest annual mean NO_2 concentration recorded was 28.3 μgm^{-3} recorded at the diffusion tube triplicate site located at 9 High Street, St Lawrence (TH70, TH71, TH72).

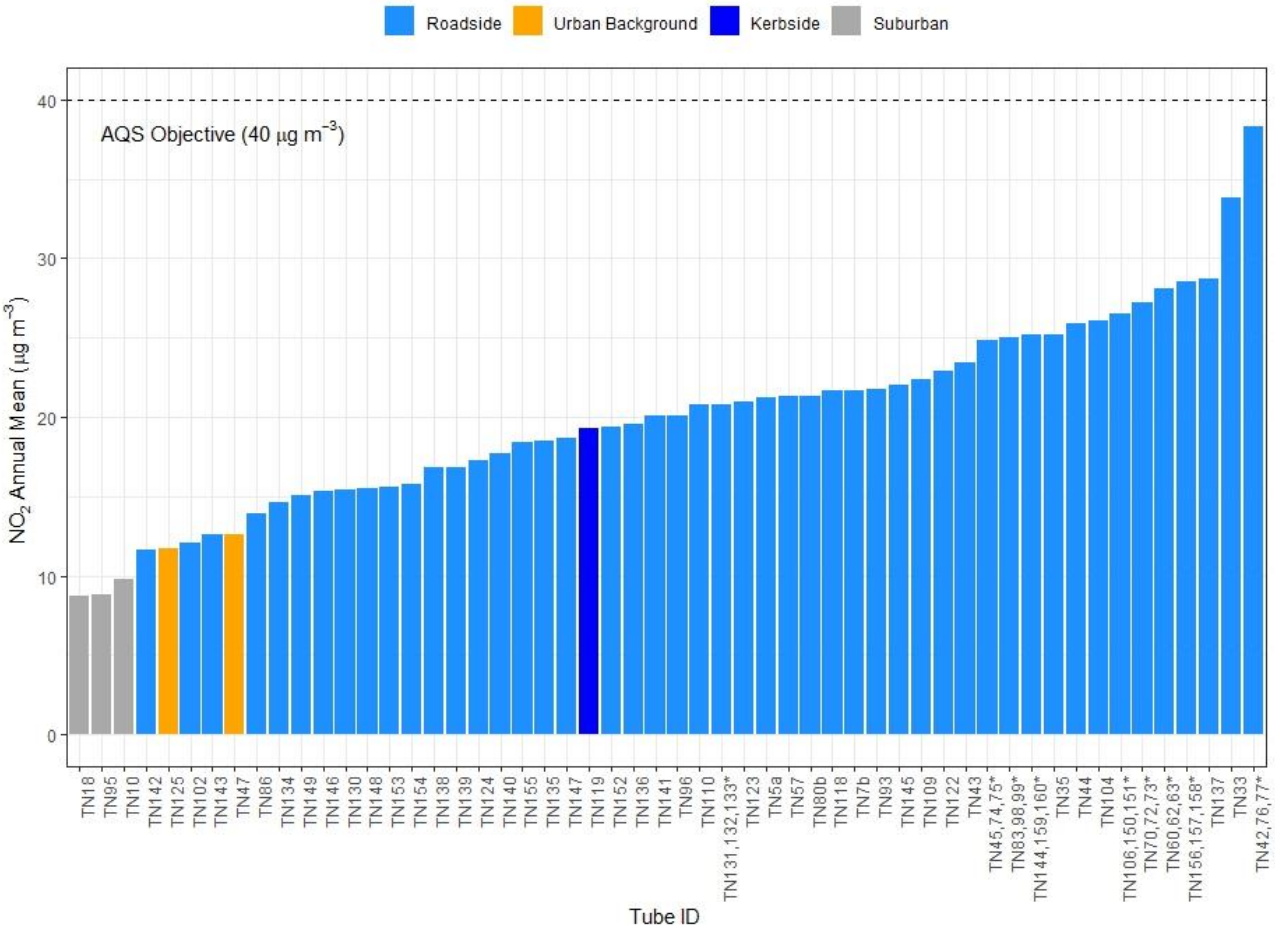
Figure 22 Thanet District Council diffusion tube NO_2 annual means for 2023.



4.1.3.10 *Tonbridge and Malling Borough Council*

In Tonbridge and Malling NO_2 annual mean concentrations were measured at 54 diffusion tube sites in 2023. Of these, 48 sites are classified as Roadside, 2 as Urban Background and 1 as Kerbside. All sites recorded annual mean NO_2 concentrations below the AQS objective. A triplicate site located on Tonbridge Road, Wateringbury (TN42, TN76, TN77) recorded an annual mean NO_2 concentration of 38.4 μgm^{-3}, which is within 10% of the AQS objective of 40 μgm^{-3}.

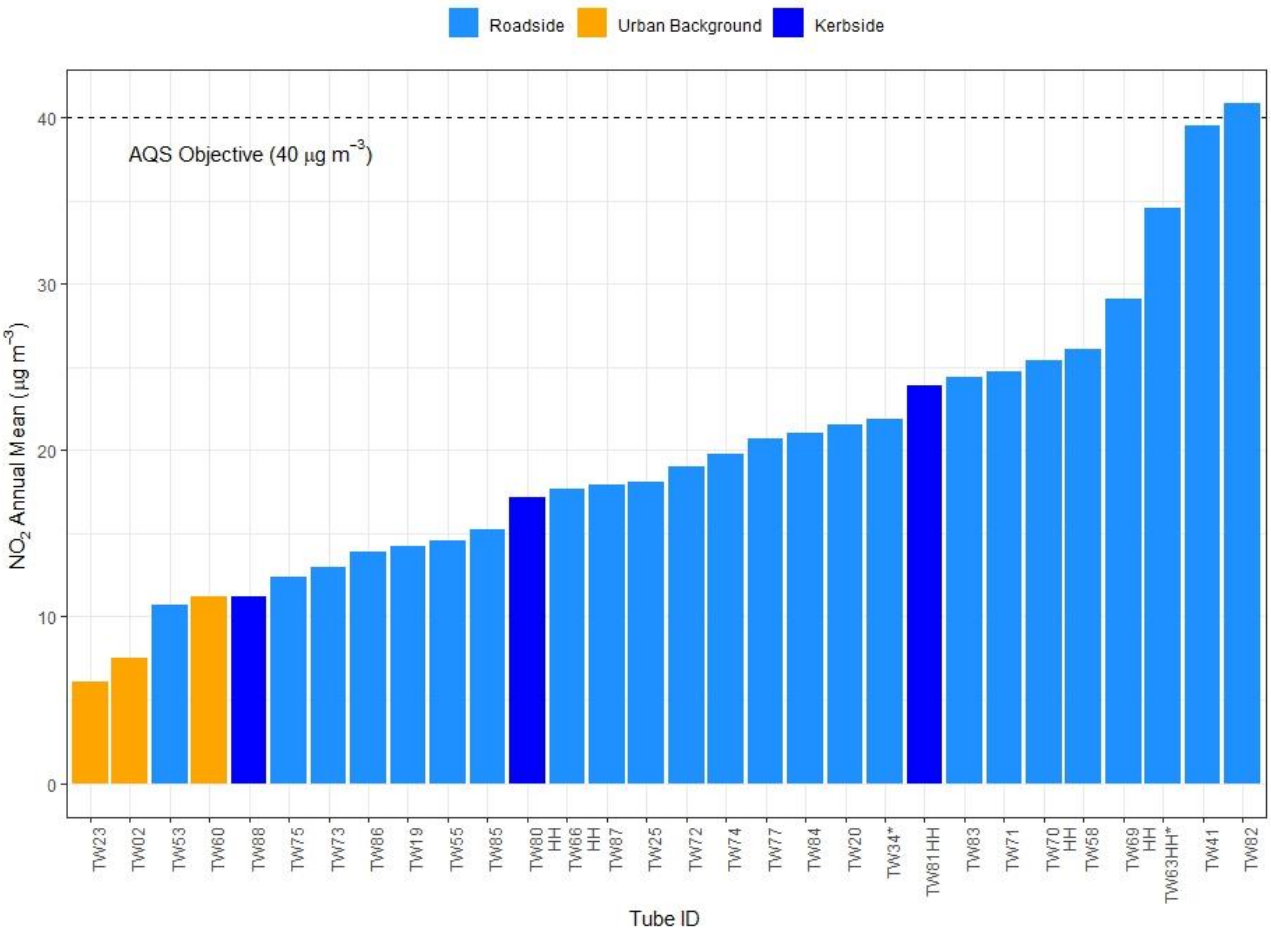
Figure 23 Tonbridge and Malling Borough Council diffusion tube NO_2 annual means for 2023.



4.1.3.11 *Tunbridge Wells Borough Council*

In Tunbridge Wells, NO_2 annual mean concentrations were measured at 30 diffusion tube sites in 2023. Of these, 24 sites are classified as Roadside, 3 as Roadside, and 3 as Urban Background. One diffusion tube site located on Pembury Road (TW82) recorded an annual mean NO_2 concentration above the AQS objective in 2023. One site also recorded an annual mean NO_2 within 10% of the AQS objective (TW41).

Figure 24 Tunbridge Wells Borough Council diffusion tube NO_2 annual means for 2023.



5. LOCAL AUTHORITY ACTIONS TO IMPROVE AIR QUALITY

In this section a summary of the air quality actions in progress or planned for the future are provided for each borough/district. Further details on local authority actions can be found in the individual Annual Status Reports (ASRs) published on the KentAir website here: https://kentair.org.uk/reports.

Ashford Borough Council

Ashford Borough Council undertook passive NO_2 monitoring at 25 diffusion tube sites in 2023. There are no automatic monitoring sites in the Borough. No diffusion tubes recorded an annual mean NO_2 concentration within 10% AQS objective. All other sites were below the objective. As such there are no AQMAs declared in the Borough.

Ashford Borough Council have continued to work to improve air quality, with the following measures in 2023:

- Contribution to the Kent Air and Care for Air websites to provide communications campaign and education resource about air quality.
- Implementation of electric vehicle charging points. In 2023, the Ashford EV charging points network contained 69 charging points.
- Planning conditions require EV charging points where appropriate.
- Completion of a 3-year scheme to encourage electric and hybrid taxis, and extensions of this until 2025.
- The major developments to be built or in operation are all in line with guidance from the Institute of Air Quality Management.
- Implemented the Handlebars vs cars campaign, encouraging cycling as a commuter option alongside recreation.
- Undertook feasibility study to extend our cycling network with contractor Sustrans for a route in central Ashford.
- Developed a new climate and anergy strategy 2024-2026 which continues to incorporate Air Quality.
- Supported Kent and Medway Air Quality Partnership in obtaining Defra funding for digital educational resource (Pollution Patrol) and contributed funding towards this project.
- Supported Kent and Medway Air Quality Partnership in obtaining Defra grant for support to public health/medical professionals, including commitment to funding.

For 2024 priorities include:

- Raise awareness of climate change and air quality to increase understanding and knowledge.
- Ensure the council's decision-making processes, strategic documents and procedures contribute to reducing carbon emissions, positively impacting biodiversity and air quality, and increasing local resilience to climate change.
- Encourage and enable a shift towards cleaner modes of transport and reduce car dependency with co-benefits to air quality and health.
- Enable business growth while maximising opportunities to reduce carbon emissions (including specific objective to strengthen anti idling messaging to improve air quality).
- Protect, enhance, and increase green space for the benefit of people and wildlife.

Canterbury City Council

Canterbury City Council monitored NO_2, PM_{10} and $PM_{2.5}$ at one automatic monitoring site and NO_2 concentrations at a second automatic monitoring site. Both automatic monitoring sites were in compliance with AQS objectives in 2023 for all pollutants. Annual NO_2 concentrations were also monitored at 33 diffusion tubes sites in 2023. All

diffusion tubes met the annual AQS objective in 2023. There are currently two AQMAs declared for NO_2 in the district.

In December 2018, an Air Quality Action Plan 2018-2023 was produced. The council have completed the following actions in 2023:

- Progressed the Air Quality Action Plan in pursuit of improving local air quality over the next 5 years.
- Encouraged sustainable alternatives to private travel that would contribute to improving air quality within the city.
- Promoted the Defra Ready to burn guide and wood burning campaigns in winter to reduce $PM_{2.5}$ concentrations.
- Worked with event venues to restrict the use of generators/equipment using solid fuel, diesel or petrol to reduce $PM_{2.5}$ concentrations.
- Updating the existing electronic signs to display real-time information on availability of parking spaces so that motorists can avoid queuing for car parks that are already full.
- Delivery of nine battery electric vans to replace nine diesel vans used by the Council's enforcement teams.

The following measures are expected to be implemented in 2024:

- Support the improvement in broadband infrastructure across the district to enable more home working and reduce vehicle movement into Canterbury.
- Implement the Wincheap road scheme, with the aim of easing rush-hour gridlock.
- Explore opportunities to enhance sustainable transport through the Canterbury District Transport Strategy.

Dover District Council

The District of Dover has one automatic monitoring site for PM_{10} concentrations, and annual mean NO_2 concentrations were recorded at 21 diffusion tube sites in 2023. Measured annual mean concentrations at all sites were below the AQS objectives. There are currently two AQMAs declared for NO_2 in the District of Dover.

Dover District Council have implemented the following measures in 2023:

- Submitted the Dover District Local Plan for examination, with the Local Plan anticipated to be adopted in 2024.
- Produced the Air Quality Action Plan for 2024-2028 for Dover District.
- Offered reduced licence fee for any taxi/private hire vehicle that is electric, hybrid or LPG.
- Succeeded in OLEV funding bid for 19 EV charging sites.
- Installed 29 public electric vehicle charging posts across the district and an additional 7 ELV chargers at the Council office car park.

Priorities for 2024 are as follows:

- Adopt the new Dover District Local Plan.
- Work with Kent County Council to improve public transport services and encourage the use of more sustainable transport modes.
- Work with KMAQP on promotional activities to raise the profile of air quality in Dover.
- Procure low emission vehicles for the LGV and HGV fleet, council-owned fleets and refuse fleet.

Folkstone and Hythe District Council

NO_2 monitoring was undertaken at 18 diffusion tube sites in Folkstone and Hythe in 2023. Annual mean concentrations at all sites were below the AQS objective. There are no declared AQMAs in Folkstone and Hythe.

Folkstone and Hythe District Council have implemented the following measures in 2023 to improve air quality:

- Working collaboratively as a member of the Kent and Medway Air Quality Partnership to develop Air Quality Planning Guidance for partner local authorities, developers and consultants.
- Implementation of a Climate Change Champions Group amongst Council staff, who actively seek to raise awareness of energy efficiency and reducing carbon emissions.
- Improvement of Ross House in Folkestone to improve the thermal efficiency of the properties broader tenant welfare as well as reduce emissions and carbon footprint.
- Using alternative lighting for streetlamps, with 321 adopted streetlights in the district being converted to light emitting diode (LED) lighting.
- Reduction of the Council's emissions by encouraging staff to work from home where applicable, and adapting the working environment to reduce the number of printers, accommodate bookable desks and meeting rooms with hybrid equipment to minimise the number of commuting journeys.
- Implementation of digital training resource for Health Care Professionals (HCPs) across the Kent and Medway Group to provide training, local evidence, and resources to enable practitioners to advise patients with cardiovascular disease (CVD) or respiratory disease on how to reduce their exposure to air pollution

Key priorities for 2024 include:

- Complete and publish an Air Quality Strategy for the District before the 2025 ASR is due.
- Engage further with senior members within the Air Quality Working Group for the Kent and Medway Air Quality Partnership, to improve communication between and input from public and voluntary sectors.
- Produce a net zero toolkit to provide guidance for developers and homeowners on how to eliminate carbon emissions in new build housing developments and refurbishment projects within the district.
- Continue social housing review and improvement to ensure reduced emissions and carbon footprint, greater tenant comfort and EPC of Band C by 2030.

Gravesham Borough Council

Gravesham Borough Council monitor NO_2 and PM_{10} at two automatic monitoring sites and NO_2 at 65 diffusion tube sites. Both NO_2 and PM_{10} at automatic monitoring sites were in compliance with AQS objectives in 2023. All diffusion tube sites recorded annual mean NO_2 concentrations below the AQS objective. One site recorded an annual mean within 10% of the AQS objective. There are currently three AQMAs declared in the Borough, two of the AQMAs are for NO_2 only, one is for NO_2 and PM_{10} combined.

Gravesham Borough Council have implemented the following measures in 2023:

- Finalising the new AQAP that incorporates all AQMAs into one AQAP.
- Undertaken a modelling assessment to review all AQMAs within Gravesham's jurisdiction to support measures within the updated AQAP.
- Encouraged sustainable alternatives to private travel that would contribute to improving air quality within the borough.
- Continued support of local initiatives such as 'Pollution Patrol' and social media campaigns to inform and educate the public on local air quality.

The main priorities for Gravesham Borough Council in 2024 are:

- Adopt and start implementing the new AQAP.
- Continue to implement and continue to progress the Climate Change Management Plan 2022.

- Continue working with partners in the Kent and Medway Air Quality Partnership (K&MAQP) to improve air quality throughout the area.
- Continue reviewing the NO_2 passive monitoring network, in order to identify any areas which may require additional monitoring and to identify any potential areas of exceedances.

Maidstone Borough Council

In 2023 Maidstone Borough Council undertook NO_2 and PM_{10} monitoring at two automatic sites. One of the automatic sites also monitored $PM_{2.5}$. The annual NO_2 AQS objective was exceeded at one automatic monitoring site. There were also 39 diffusion tube sites for monitoring NO_2. Five of the diffusion tube sites recorded annual mean NO_2 concentrations above the AQS objective in 2023. Maidstone has one AQMA declared for NO_2.

Maidstone Borough Council have implemented a number of measures to improve air quality in 2023, these include:

- Published the new Air Quality Action Plan for the new Upper Stone Street AQMA.
- Improved Maidstone's bus fleet to reduce the contribution of the fleet to NOx emissions.
- Undertaken an information campaign to residents of the new AQMA.
- Extension to the Clean Air for Schools (CAFS) programme.
- Prioritise the AQMA and surrounding areas for roll out of new DEFRA funded Health Professionals AQ resource.
- Published a campaign of anti-idling signage across the Borough, focussing on schools and other known or identified problem areas.

The priorities of Maidstone Borough council for 2024 are:

- Engage with bus service providers to encourage improvement to bus fleet in Maidstone, with special emphasis on services operating on Upper Stone Street
- Explore expansion of the additional parking restrictions already introduced on Upper Stone Street to include adjacent roads such as Palace Avenue and Knightrider Street
- Extension to the Clean Air for Schools (CAFS) programme, with emphasis on roll-out of the Pollution Patrol Resource.
- Review provision of EV parking in Council car parks

Medway Council

Medway Council undertook automatic continuous monitoring at two sites and diffusion tube monitoring of NO_2 at 52 sites during 2023. Measured NO_2 concentrations at the automatic monitoring sites were in compliance with the AQS objectives. One diffusion tube recorded an annual mean above the AQS objective, and four diffusion tube sites recorded NO_2 concentrations within 10% of the annual AQS objective in 2023. Medway currently has four AQMAs declared for NO_2.

To improve air quality, Medway council has implemented the following measures in 2023:

- Secured a grant to help implement several action plan measures.
- Successfully secured a DEFRA Air Quality Grant of £126,000 to carry out a taxi and private hire ULEV feasibility study.
- Worked with Kent County Council to review the Regional Freight Strategy.
- Development of an air quality communications strategy with public relations team
- Setting up of AQAP Steering Group and book 6 monthly meetings with stakeholders.

In 2024, the main priorities of Medway council will be:

- Progressing the three projects funded by the air quality grants.

- Progressing with the measured outlined in the 2022 Four Elms Hill AQAP.
- Completing the ongoing review of the 2015 AQAP.
- Medway Council are also seeking to revoke the Pier Road Gillingham AQMA given the ongoing compliance with national Air Quality Objectives within the designated AQMA as proven with monitoring results.
- Should 2024 monitoring data continue to show a continuation of compliance with national Air Quality Objectives within the Rainham AQMA, Medway Council will also seek to revoke the Rainham AQMA as part of next year's air quality review and assessment work.
- Undertake a taxi and private hire ULEV feasibility study.

Swale Borough Council

Swale Borough Council has three automatic monitoring stations in operation. All stations measured NO_2 and PM_{10} and two sites measured $PM_{2.5}$ in 2023. NO_2 concentrations at the three automatic monitoring sites met their AQS objectives in 2023. There were no exceedances of the PM_{10} annual mean, however there were 42 exceedances of the 24-hour mean limit of 50 μgm^{-3} (which is not to be exceeded more than 35 times per year) at one site. $PM_{2.5}$ was below the annual mean objective at both sites. In addition Swale monitored NO_2 at 78 diffusion tube sites. All diffusion tube locations recorded an annual mean NO_2 concentration below the AQS objective. Swale currently has six AQMAs declared, five of these are for NO_2 and one is for NO_2 and PM_{10} combined.

Swale Borough Council have been working to improve air quality, including:

- MidKent Partnership was successful for funding via DEFRA Air Quality Grant for a 5 -year project to develop a digital training resource for Health Care Practitioners across Kent and Medway
- Further engagement with schools through Swale's Green School Forum continues, providing holistic engagement on both air quality, ecological and climate actions.
- Local Cycling and Walking Infrastructure Plans (LCWIP) -Stage 1 completed.
- Launched a second car club in Sittingbourne with 3 hybrid vehicles.
- Continued implementation of anti-idling campaign, with additional enforcement patrols enforced in hotspot locations.
- Continued work on a Traffic Management Project to review traffic management at St Paul's Street AQMA
- Continued promotion and raising awareness of KentAir alert messaging, air quality impacts and solutions through KentAir week, Clean Air Day and the Green Schools Forum.
- Conducted real-time measurements within the St Pauls Street AQMA to better understand the spatial extent of the particulate matter emissions.

For 2024, priorities include:

- Complete the Traffic Management Project to review traffic management options at St Paul's Street AQMA.
- Provide final report and findings for the additional real time measurements using the Praxis Cube sensor at St Paul's Street.
- Complete additional real time monitoring using the Praxis Cube sensor in Teynham AQMA.
- Continue anti-idling patrols and raising awareness of the anti-idling campaign in hotspot locations.
- Continue the Swale's Green School Forum to support air quality and climate initiatives.
- Review and update the Air Quality and Planning Technical Guidance and the Air Quality policy (DM 33).
- Commission a Sittingbourne & Iwade Active Travel Connectivity Feasibility Study.
- Liaise with Medway Council to discuss transboundary impacts and mitigation options. Working towards lowering NO_2 emissions in Newington and Keycol Hill AQMAs.

Thanet District Council

Thanet District Council undertook automatic monitoring of NO_2 and PM_{10} at two sites during 2023. Monitoring of NO_2 was also undertaken at 43 diffusion tube sites. There were no exceedances of the annual mean NO_2 AQS objective at any of the automatic or diffusion tubes sites. Measured PM_{10} concentrations also complied with AQS objectives. Thanet currently has one declared AQMA for NO_2.

Thanet District Council has successfully implemented the following measures in 2023:

- Revocation of Thanet Urban AQMA and declaration of smaller Ramsgate AQMA.
- Progress the Taxi Licensing Policy, which is currently being updated. This will include incentives for ULEV and age restrictions of the existing fleet.
- Progress the social media campaign on air quality.
- Assist Kent and Medway Air Quality Partnership (KMAQP) funding the development of a resource for Air Pollution Training for healthcare professionals.
- Pollution Patrol school resource to educate children on air pollution and the impact on health.
- The Kent and Medway Energy and Low Emission Strategy has been adopted and a travel plan monitoring officer appointed at Kent County Council.
- The Jambusters website was set up for Kent County Council's school travel plans.
- Completed Thanet Parkway Train Station construction.
- Formal adoption of TDC Net Zero Action Plan 2024 and Strategy.

The District Council's priorities for 2023 are:

- Revocation of the Ramsgate AQMA and production of a Thanet wide AQ strategy.
- Continue to engage with land-use and transport planners to ensure the actions adhere to the Local Plan and are supported by all parts of the authority.
- Continue to raise awareness of air quality issues within the district.
- Continue to work with Kent County Council to undertake identified feasibility studies of measures to tackle air pollution, to determine more robustly the effectiveness and cost of options.
- Encourage the public to use sustainable transportation, including public transport, car sharing, cycling, and walking.
- Continue the partnership with Kent County Council to engage in a joint approach to tackle air quality issues and the implementation of the Thanet Transport Strategy.
- To progress KMAQP proposal for Air Pollution Training for healthcare professionals.
- Continue to work with Sustrans to support development plans to connect rural areas.
- Continue to work on updating the Thanet Air Quality Technical Planning Guidance for inclusion with the new AQAP is underway which will require all major development in Thanet to be accompanied by an AQ assessment and Emission Mitigation Assessment as part of the planning application validation process.
- Continue the anti-idling powers to enable effective campaigning and enforcement in areas of poor air quality.

Tonbridge and Malling Borough Council

Tonbridge & Malling Borough Council undertook automatic monitoring of at two sites during 2023. One site measured NO_2 only, and the other site measured both NO_2 and PM_{10}. The council also undertook passive monitoring of NO_2 at 54 diffusion tube sites in 2023. Both automatic monitoring sites showed compliance with AQS objectives for NO_2 and PM_{10}. All diffusion tube sites recorded annual mean NO_2 concentrations below the AQS

objective. One site recorded an annual mean NO_2 concentration within 10% of the AQS objective. Tonbridge & Malling Borough Council have declared six AQMAs, all for NO_2.

Key measures completed by Tonbridge and Malling Borough Council include:

- Completion of phase 1 of EV charging

Tonbridge & Malling Borough Council expects the following measures to be completed in 2024:

- Explore the process for possible standardising Section 106 agreement funding from development for AQ improvements.
- Increasing Vegetation across the borough with green walls.
- Roll out phase 2 of the anti-idling campaign with further signage around more schools and other idling hot spots such as taxi ranks and bus stops.
- Continue engagement with schools on Air Pollution and simple steps to help tackle it.
- Make progress in establishing a Car Club in the Borough.

Tunbridge Wells Borough Council

Tunbridge Wells Borough Council undertook automatic monitoring of NO_2, PM_{10} and $PM_{2.5}$ at one site and passive monitoring of NO_2 at 30 diffusion tube sites, during 2023. NO_2, PM_{10} and $PM_{2.5}$ measured at the automatic monitoring site met their AQS objectives in 2023. One diffusion tube site recorded an annual mean NO_2 concentration above the AQS objective and one diffusion tube site recorded an annual mean NO_2 concentration within 10% of the AQS objective. Tunbridge Wells Borough Council currently have two AQMAs declared for NO_2.

Key measures completed by Tunbridge Wells Borough Council to improve air quality in 2023 include:

- Support for measures to increase the use of sustainable transport modes such as walking and cycling.
- Considered the establishment of an Air Quality Protection zone to replace the AQMA, once confident the AQMA can be revoked.
- Expansion of the Car Club scheme.
- Investigated a Low Emission Standard for buses.
- Incorporation of an air quality Supplementary Planning Document (SPD) into the emerging Local Plan.
- Use S106 funding to introduce a bike share scheme.
- Engaged with schools to reduce the impact of school traffic.
- Launch of the Pollution Patrol digital resource, funded by a grant from DEFRA awarded in 2022.
- Produced and deployed anti-idling signage.

Priorities for Tunbridge Wells Borough council in 2023 include:

- Review the main A26 AQMA, with a view to starting the process of its revocation.
- Extension to the Clean Air for Schools (CAFS) programme, with emphasis on roll-out of the Pollution Patrol Resource.
- Find commercial sponsorship for the Pollution Patrol resource, in partnership with Maidstone Brough Council, to ensure that it continues to be available and kept up to date after the DEFRA funding is exhausted.
- Continue the development of the Health Care Practitioner's Air Quality Resource, which forms the basis of our latest DEFRA funded project.