Maidstone Borough Council
Air Quality Action Plan

In fulfilment of Part IV of the
Environment Act 1995
Local Air Quality Management

Date September 2023

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Executive Summary

This Air Quality Action Plan (AQAP) has been produced as part of our statutory duties required by the Local Air Quality Management framework. It outlines the action we will take to improve air quality in Maidstone Borough Council between 2023 and 2028.

This action plan replaces the previous action plan (the Low Emission Strategy) which ran from 2018-2023. Projects delivered through the past action plan include:

- A major review of possible measures to improve air quality in Upper Stone Street. This review considered a large number of measures which might improve air quality in Upper Stone Street but the result of this consideration suggested that none of the measures would not bring forward compliance with the annual mean objective for NO_2 significantly and that with some of the measures, there was a danger of simply displacing the air quality issues in Upper Stone Street to a different location. Also, the cost of some of the measures would have been prohibitive.
- Introduction of variable off-street parking charges to make car parks further out of town more attractive.
- Tightening waiting and loading restrictions in Upper Stone Street. Single yellow lines have been replaced with double yellow lines, and loading restrictions were also increased (no loading between 7:00am to 8:00pm).
- Improved maintenance of Council owned EV charging points with daily inspection routine.
- Delivering our Clean Air For Schools (CAFS) programme and the associated DEFRA funded ‘Pollution Patrol’ Project.

Figure 1:- Anti-idling sign based on Pollution Patrol Artwork

- Updated Planning Guidance
- Review of Air Quality Monitoring Provision in Maidstone. The outcome of this review was that continuous monitoring was installed in Upper Stone Street, which included monitoring of $PM_{2.5}$ for the first time in Maidstone, in addition to monitoring of NO_2 and PM_{10}.

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 and older people, and those with heart and lung conditions. There is also often a strong correlation with

equalities issues, because areas with poor air quality are also often the less affluent areas[1,2].

The annual health cost to society of the impacts of particulate matter alone in the UK is estimated to be around £16 billion[3]. Maidstone Borough Council is committed to reducing the exposure of people in Maidstone Borough to poor air quality in order to improve health.

We have developed actions that can be considered under five broad topics:

- Policy guidance and development control
- Promoting low emission transport
- Public information
- Traffic management
- Vehicle fleet efficiency
- Promoting travel alternatives
- Alternatives to private vehicle use

Our priorities are

- Priority 1 – Improvements to bus fleet. Modelling has shown that the number of receptors in an exceedance of the NO_2 annual mean objective could be reduced from 27 in 2022 to 18, by restricting the buses operating on Upper Stone Street to Euro VI class, via the Enhanced Partnership Scheme Monitoring Groups (EPSMGs) and the District Focus Groups which have replaced the Quality Bus Partnership.
- Priority 2 – Improved traffic flow in AQMA – by exploring the expansion of parking restrictions to neighbouring roads.
- Priority 3 – Public information – via our two DEFRA funded projects, and anti idling campaign.
- Priority 4 – Application of MBC policy – ensure that MBC polices are updated and designed to either improve air quality or to prevent worsening of air quality by inappropriate development. This will be predominantly via the councils emerging Design and Sustainability DPD
- Priority 5 – Encourage improvement to EV charging provision – via review of councils own charging provision and potential incentives for uptake by residents.

[1] Environmental equity, air quality, socioeconomic status and respiratory health, 2010
[2] Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[3] Defra. Abatement cost guidance for valuing changes in air quality, May 2013

In this AQAP we outline how we plan to effectively tackle air quality issues within our control. However, we recognise that there are many air quality policy areas that are outside of our influence (such as vehicle emissions standards agreed in Europe).,.

Responsibilities and Commitment

This AQAP was prepared by the Environmental Health Department of Maidstone Borough Council with the support and agreement of the following officers and departments:

- Kent County Council (Various Teams)
- MBC Development Management Team
- MBC Planning Policy Team
- MBC Parking Services Team
- MBC Biodiversity and Climate Change Team
- Local Council Members

This AQAP has been approved by:

Maidstone Borough Council Corporate Leadership Team

Maidstone Borough Council Communities, Housing and Environment Policy Advisory Committee

Maidstone Borough Council Cabinet

This AQAP will be subject to an annual review, appraisal of progress and quarterly reporting to the steering group set up to monitor progress. Progress each year will be reported in the Annual Status Reports (ASRs) produced by Maidstone Borough Council, as part of our statutory Local Air Quality Management duties.

If you have any comments on this AQAP please send them to Dr Stuart Maxwell at:

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1 Introduction

This report outlines the actions that Maidstone Borough Council will deliver between 2023-2028 in order to reduce concentrations of air pollutants and exposure to air pollution; thereby positively impacting on the health and quality of life of residents and visitors to Maidstone Borough Council's administrative area.

It has been developed in recognition of the legal requirement on the local authority to work towards Air Quality Strategy (AQS) objectives under Part IV of the Environment Act 1995 and relevant regulations made under that part and to meet the requirements of the Local Air Quality Management (LAQM) statutory process.

This Plan will be reviewed every five years at the latest and progress on measures set out within this Plan will be reported on annually within Maidstone Borough Council's air quality ASR.

2 Summary of Current Air Quality in Maidstone Borough

Please refer to Maidstone Borough Council's 2023 ASR

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[4,5].

The mortality burden of air pollution within the UK is equivalent to 28,000 to 36,000 deaths at typical ages[6], with a total estimated healthcare cost to the NHS and social care of £157 million in 2017[7].

Maidstone is the county town of Kent. Kent is the most populous County Council area in the Southeast Region. There are currently estimated to be 1,578,500 people living within the Kent County Council area. The population of Kent increased from 1,466,500 in 2011 to 1,578,500 in 2021, which was an increase of 7.64%. In the same period, the population of Maidstone increased from 155,800 to 176,700 people, based on figures from Kent County Council, making it the largest population of any Local Authority in Kent. This represented an increase of 13.45%, which was also the largest population increase in real terms of all the local authorities in Kent. Maidstone's population is expected to increase to 189,800 by 2030. Around 17,600 new homes are to be provided within the planning period 2011 to 2031. The Borough is home to 11.2 per cent of the population of the Kent County Council area (2021 estimate from KCC website) and borders Swale, Ashford, Tunbridge Wells and Tonbridge and Malling Boroughs, as well as Medway Unitary Authority.

The Borough of Maidstone includes the large urban area of Maidstone as well as several small rural settlements. Its countryside, set within 'the Garden of England', is of a high landscape quality and includes the Kent Downs Area of Outstanding Natural Beauty.

[4] Public Health England. Air Quality: A Briefing for Directors of Public Health, 2017
[5] Defra. Air quality and social deprivation in the UK: an environmental inequalities analysis, 2006
[6] Defra. Air quality appraisal: damage cost guidance, July 2020
[7] Public Health England. Estimation of costs to the NHS and social care due to the health impacts of air pollution: summary report, May 2018

The main source of air pollution in the Borough is traffic emissions from major roads. An Air Quality Management Area (AQMA) was declared in August 2008 which incorporated the whole Maidstone urban area and the M20 corridor, where exceedances of the annual mean objective for nitrogen dioxide (NO_2) and 24-hour mean objective for fine particulate matter (PM_{10}) were predicted. This was replaced in 2018 by a smaller AQMA which followed the carriageways of the main roads through the borough. This AQMA was declared solely on exceedances of the NO_2 annual mean objective, and was in turn replaced by the current AQMA in 2022.

Maidstone Borough Council currently operates two automatic (continuous) monitoring stations. These are a roadside site in Upper Stone Street which monitors NO_2, PM_{10} and $PM_{2.5}$ and a rural background site in Detling which monitors NO_2 and PM_{10}. The https://kentair.org.uk/data/data-selector page presents automatic monitoring results for Maidstone Borough Council, with automatic monitoring results also available through the UK-Air website.

In 2022 MBC also monitored NO_2 by diffusion tube at 57 different locations, which means that in total we have now monitored at more than 150 locations in the Borough. 2022 was the first year since 2019 in which NO_2 levels were not affected by COVID restrictions. NO_2 levels were broadly very similar to those in 2021, and well below 2019 levels. All LAQM air quality objectives were met at all locations across the Borough, with the exception of in the Upper Stone Street AQMA where the NO2 annual mean objective was exceeded. All other LAQM objectives were met in Upper Stone Street. In Upper Stone Street, all of the monitoring sites remained above the NO_2 annual mean objective including Maid 123 which recorded 40.9µgm^{-3}, which had previously fallen below the objective in the COVID affected years of 2020 and 2021. Only one site exceeded 60µgm^{-3} in 2022, namely Maid 96, which at 62.5µgm^{-3} was slightly down on the 2021 level of 62.6µgm^{-3}.

The annual mean level of NO_2 recorded by the automatic monitoring station in Upper Stone Street in 2022 was 47µgm^{-3}; slightly lower than the level in 2021 which was 49µgm^{-3}. The 2019, pre-pandemic level at the automatic monitoring station was 68µgm^{-3}.

During 2022, exceedances of the NO_2 annual mean AQS objective were recorded at seven non-automatic monitoring sites, all of which were located within the Maidstone Borough AQMA. These included six sites at which exceedances were measured in 2020 and 2021. The seven sites were:

- Maid 53 at The Wheatsheaf Public House.
- Maid 81 at The Pilot on Upper Stone Street;
- Maid 96 at Lashings Sports Club on Upper Stone Street.
- Maid 116 at 37 Forstal Road Cottages
- Maid 122 at Papermakers Arms PH, Upper Stone Street
- Maid 123 Upper Stone Street, opposite Maid 122
- Maid 128 Triplicate co-location site with continuous monitoring station in Upper Stone Street.

Levels at Maid 53, Maid 81, Maid 96, Maid 116 and Maid 128 showed a slight decrease compared to 2021 levels, whereas levels at the Maid 122 and Maid 123 had slightly increased. Four of these seven sites, (Maid 53, Maid 116, Maid 123 and Maid 128) were below the objective once distance corrected to the nearest relevant receptor as shown in Table B1. The Wheatsheaf was scheduled for demolition in 2021. Although the demolition has been delayed and we are unsure when it will happen, the property remains empty, so not a cause for concern in air quality terms. Overall, following distance correction, 3 sites remained above the objective, all in Upper Stone Street.

Figure 2: View of Upper Stone Street Looking Uphill (South) with AQ Station on the Right

AQC's detailed assessment report, undertaken in 2021 and based on 2019 (pre-pandemic data, confirmed that the previous Maidstone Borough AQMA could be revoked, with the only remaining area of exceedance being in Upper Stone Street, between Wrens Cross and Old Tovil Road. The annual mean objective for NO_2 applies primarily at residential property. It was estimated that the previous Maidstone Borough AQMA contained some 1400 residential properties. AQC's report suggests that in 2019 there were only 44 residential properties in an exceedance of the NO_2 annual mean objective, all of which were in Upper Stone Street and that these properties would need to remain in an AQMA when the Maidstone Borough AQMA

was revoked. Of these 44 residential receptors 35 are in the range 40 to 60µgm^{-3} and a further 9 are at a level of over 60µgm^{-3}.

AQC also modelled a scenario for 2022, which concluded that without any intervention, the number of receptors experiencing an exceedance of the NO2 annual mean objective would reduce from 44 to 27, of which an annual mean concentration of 60 µg/m3 is exceeded at approximately three of those receptors. As shown in Table A3, the NO_2 annual mean level measured at the air quality monitoring station in Upper Stone Street decreased from 68 in 2019 to 47 in 2022.

Maidstone Borough Council, following the findings of AQC's detailed assessment, revoked the Maidstone Borough AQMA on 1st December 2022, and on the same date, declared a new small AQMA in Upper Stone Street. The relevant orders are shown below.

ENVIRONMENT ACT 1995 PART IV SECTION 83(2)(b) AS AMENDED BY ENVIRONMENT ACT 2021

MAIDSTONE BOROUGH COUNCIL

AQMA REVOCATION ORDER (2022)

MAIDSTONE BOROUGH COUNCIL, IN EXERCISE OF THE POWERS CONFERRED UPON IT BY SECTION 83(2)(b) OF THE ENVIRONMENT ACT 1995, HEREBY MAKES THE FOLLOWING ORDER.

1 This order shall revoke the Maidstone Borough Air Quality Management Area (2018)

2 The order shall come into force on 1st December 2022

THE COMMON SEAL OF MAIDSTONE BOROUGH COUNCIL WAS HERETO AFFIXED ON 8 DECEMBER 2022 AND SIGNED IN THE PRESENCE OF CLAUDETTE VALMOND ON BEHALF OF SAID COUNCIL.

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ENVIRONMENT ACT 1995 PART IV SECTION 83(1) AS AMENDED BY ENVIRONMENT ACT 2021

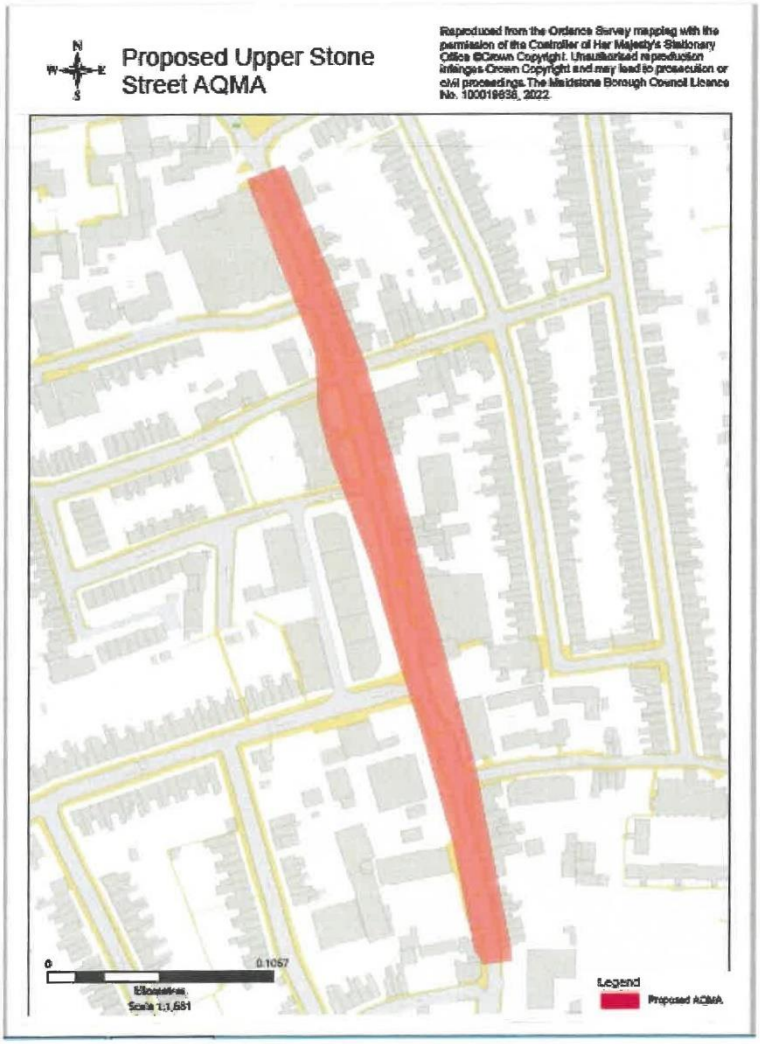
MAIDSTONE BOROUGH COUNCIL

AQMA ORDER

MAIDSTONE BOROUGH COUNCIL, IN EXERCISE OF THE POWERS CONFERRED UPON IT BY SECTION 83(1) OF THE ENVIRONMENT ACT 1995, HEREBY MAKES THE FOLLOWING ORDER.

This Order may be cited as the Maidstone Upper Stone Street Air Quality Management Area (2022) and shall come into effect on 1st December 2022. The area shown in red on the attached map "Proposed Upper Stone Street AQMA" is to be designated as an air quality management area (the designated area). The designated area incorporates the stretch of Upper Stone Street between Wrens Cross and Old Tovil Road. This Area is designated in relation to a breach of the nitrogen dioxide (annual mean) objective as specified in the Air Quality Regulations 2000. This Order came into force on 1 December 2022 and shall remain in force until it is varied or revoked by a subsequent order.

THE COMMON SEAL OF MAIDSTONE BOROUGH COUNCIL WAS HERETO AFFIXED ON 8 DECEMBER 2022 AND SIGNED IN THE PRESENCE OF CLAUDETTE VALMOND ON BEHALF OF SAID COUNCIL.



AUTHORISED SIGNATORY

3 Maidstone Borough Council's Air Quality Priorities

3.1 Public Health Context

As detailed in Policy Guidance LAQM.PG22 (Chapter 8), local authorities are expected to work towards reducing emissions and/or concentrations of $PM_{2.5}$ (particulate matter with an aerodynamic diameter of 2.5µm or less). There is clear evidence that $PM_{2.5}$ has a significant impact on human health, including premature mortality, allergic reactions, and cardiovascular diseases.

New (2021) data from the Public Health Outcomes Framework (indicator D01) indicates that for the fraction of deaths, attributable to $PM_{2.5}$, in Maidstone Borough is 5.3%. This is lower than the national average of 5.5%.

We note that in Maidstone, annual mean $PM_{2.5}$ levels measured in Upper Stone Street, which has the highest levels of pollution in the Borough, remained at 14µgm^{-3}, which was the same level as it was in 2021. We believe that the Covid pandemic may have had some impact on pollution levels in the early part of 2021, but that this was not the case in 2022, which we regard as the first year unaffected by Covid since 2019. The $PM_{2.5}$ level in Upper Stone Street in 2019 was 18µgm^{-3}. We note that the level is required to be below the objective of 10µgm^{-3} by 2040.

3.2 Planning and Policy Context

Maidstone's Local Plan Review (covering the period from 2021 to 2038) is at an advanced stage and provisionally scheduled for adoption in late 2023. Once adopted, it will replace the current Maidstone Borough Local Plan 2011 - 2031 and carry full weight in determining planning applications.

The Local Plan Review policies relevant to air quality include:-

- Policy LPRTRA1 Air Quality, development that might affect air quality,
- Strategic Policy LPRSP14(C) Climate Change
- Policy LPRSP12 Sustainable Transport,
- Policy LPRTRA4 Parking

- Policy LPRTRA2 assessing transport impacts of development.

The Design and Sustainability DPD is currently being prepared. This document contains more detailed guidance on issues including, but not limited to, air quality mitigation, sustainable construction and biodiversity and green infrastructure. The emerging sustainability DPD is approaching regulation 19 consultation stage, following which it will be submitted to the Secretary of State and will be subject to an examination in public. If found sound and adopted, it will form part of the development plan for the borough and will have same weight as the local plan review in decision making.

Maidstone Borough Council declared a Climate Change and Biodiversity Emergency in 2019; following this, the Council prepared a Biodiversity and Climate Change Strategy[1] which sets out how the Council will meet its ambition to achieve carbon neutrality by 2030; this strategy is supported by the Biodiversity and Climate Change Action Plan[1]. The Action Plan was reviewed and updated in April 2023 as part of the scheduled annual review; a succinct version of the revised action plan is published on the Council's website.

https://climatechange.maidstone.gov.uk/home/our-biodiversity-and-climate-change-action-plan

3.3 Source Apportionment

The AQAP measures presented in this report are intended to be targeted towards the predominant sources of emissions within Maidstone Borough Council's area.

A source apportionment exercise was carried out by Maidstone Borough Council in 2020, looking specifically at emissions sources in Upper Stone Street. This identified that within the AQMA, the percentage source contributions were as follows

Table 3.1: Percentage Source Contribution at Various Receptors

Vehicle Type	NOx	PM_{10}	$PM_{2.5}$
Petrol Cars	5.0%	28.7%	25.8%
Diesel Cars	36.6%	31.1%	32.7%
Petrol LGVs	0.0%	0.2%	0.2%
Diesel LGVs	19.3%	14.2%	13.8%
Rigid HGVs	15.9%	9.7%	10.3%
Artic HGVs	6.4%	7.4%	7.5%
Buses/Coaches	16.4%	7.1%	8.2%
Full Hybrid Petrol Cars	0.1%	1.1%	1.0%
Plug-In Hybrid Petrol Cars	0.0%	0.3%	0.3%
Full Hybrid Diesel Cars	0.2%	0.2%	0.2%
FCEV LGVs	0.0%	0.0%	0.0%
CNG Buses	0.0%	0.0%	0.0%
Hybrid Buses	0.1%	0.1%	0.1%
FCEV Buses	0.0%	0.0%	0.0%

Diesel cars are the biggest contributor to both NO_2 and PM pollution. The second largest contributor to NO_2 are buses, which is why we are especially keen to see some improvements to our bus fleet. Modelling has shown that the number of receptors exceeding the objective would be halved if only Euro VI buses were able to operate on Upper Stone Street. See Appendix C

3.4 Required Reduction in Emissions

The improvement in road NOx emissions in order to meet the objective at modelled locations (as presented in the Detailed Assessment reference J10/12378A/10A/1/F3, dated 23rd February 2022), see Figure 3, where concentrations exceeded the objective in 2019, is shown in Table 2. As there were a relatively large number of

locations exceeding the objective, a handful have been chosen, including the worst-case location, which are representative of the area of exceedance. As set out in LAQM Technical Guidance TG22 paragraph 7.116 any required percentage reductions of local emissions should be expressed in terms of NOx due to local road traffic. This is because the primary emission is NOx and there is a non-linear relationship between NOx concentrations and NO_2 concentrations. The following calculations use the 'modelled NO_2 concentrations' presented in the Detailed Assessment, and the methodology set out in TG22 Box 7.6. The 'Road NOx - current' concentration has been modelled. The road NOx concentration required to give a total NO_2 concentration of 40µg/m^3 (road NOx-required) has been calculated using the NOx to NO_2 calculator by entering a total NO_2 concentration of 40µg/m^3, along with the local background NO_2 concentration. The ratio of 'road NOx-required' to 'road NOx-current' gives the required percentage reduction in local road NOx emissions to achieve the objective.

An 81% decrease in road NOx emissions from 2019 is required to meet the objective at the worst-case modelled location. However, as noted in the Detailed Assessment, the model is considered to over-predict concentrations at the junction of Upper Stone Street, Knightrider Street, Mote Road and Lower Stone Street (where the worst case modelled receptor 37 is located) and conversely slightly under-predict at the section of Upper Stone Street between Brunswick Street and Old Tovil Road. Therefore the percentage reductions required should be used as indicative to those required to achieve the objective based on 2019 modelled concentrations.

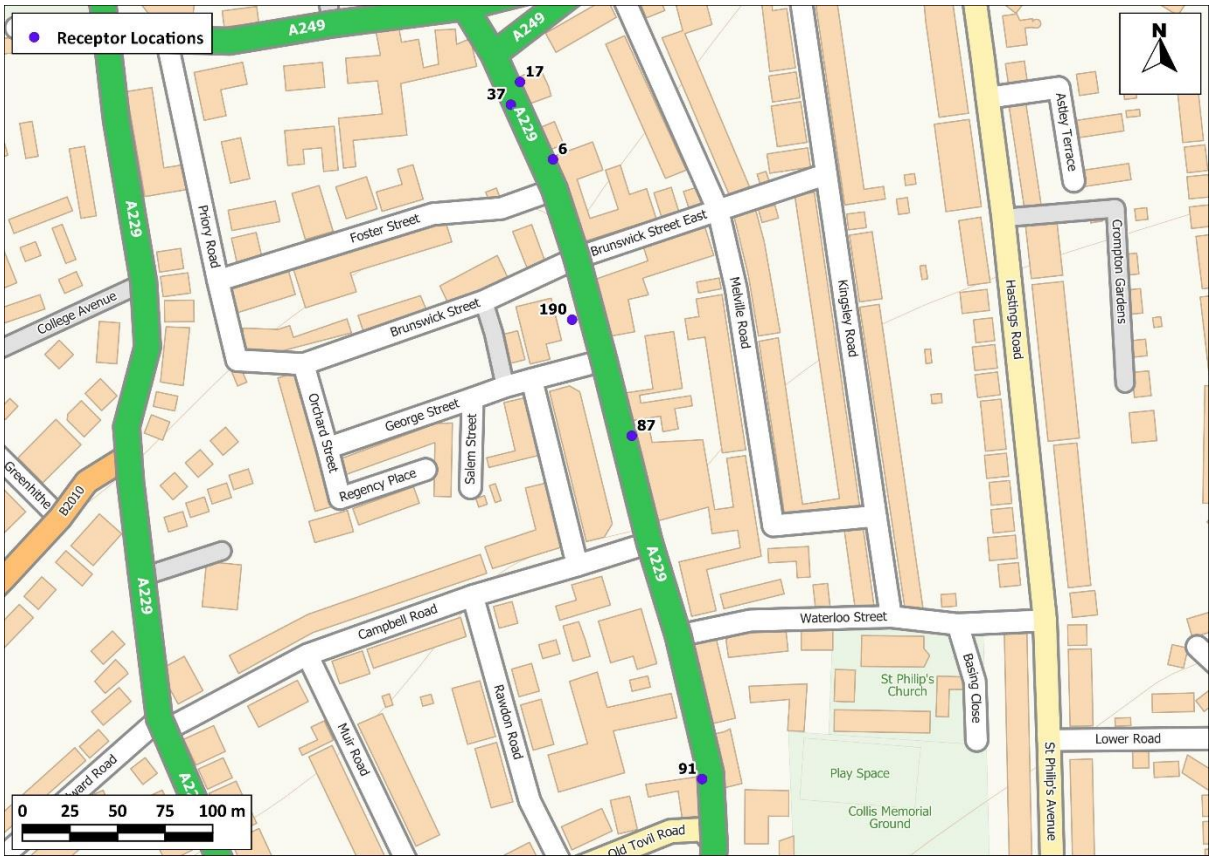
Table 2.2: Percentage Decrease in Road NOx required to Meet Annual Mean NO_2 Objective at Relevant Modelled Receptors (µg/m^3) in 2019

Receptor	Annual Mean Contribution (µg/m^3)					% Decrease in Road NOx to Meet Objective
	Modelled NO_2 Concentration	Road NOx - Current (a)	Road NOx – Required (b)	Background NO_2 (for information)	Difference between a and b [c]	
6 [a]	71.3	124.7	43.7	18.6	81.0	65
17 [a]	68.9	117.6	43.7	18.6	73.9	63
37 [b]	106.9	235.4	43.7	18.6	191.7	81
87 [b]	57.6	86.8	43.7	18.6	43.1	50

91 [b]	64.0	112.0	50.8	15.2	61.2	56
190 [b]	57.6	86.6	43.7	18.6	42.9	50

[a] modelled at 4.5m
[b] modelled at 1.5m
[c] based on unrounded numbers

Figure 3: Receptor Locations from Table 2



3.5 Key Priorities

- Priority 1 – Improvements to bus fleet. Modelling has shown that the number of receptors in an exceedance of the NO_2 annual mean objective could be reduced from 27 in 2022 to 18, by restricting the buses operating on Upper Stone Street to Euro VI class, via the Enhanced Partnership Scheme Monitoring Groups (EPSMGs) and the District Focus Groups which have replaced the Quality Bus Partnership.
- Priority 2 – Improved traffic flow in AQMA – by exploring the expansion of parking restrictions to neighbouring roads.
- Priority 3 – Public information – via our 2 DEFRA funded projects, and anti idling campaign.

- Priority 4 – Application of MBC policy – ensure that MBC polices are updated and designed to either improve air quality or to prevent worsening of air quality by inappropriate development.
- Priority 5 – Encourage improvement to EV charging provision – via review of councils own charging provision and potential incentives for uptake by residents.

4 Development and Implementation of Maidstone Borough Council's AQAP

4.1 Consultation and Stakeholder Engagement

In developing/updating this AQAP, we have worked with other local authorities, agencies, businesses and the local community to improve local air quality. Schedule 11 of the Environment Act 1995 requires local authorities to consult the bodies listed in Table 4.1. In addition, we have undertaken the following stakeholder engagement:

- Web based survey
- Press releases to local media organisations
- Emails to statutory consultees

The response to our consultation stakeholder engagement is given in Appendix A.

Table 4.1 – Consultation Undertaken

Yes/No	Consultee
Yes	the Secretary of State
Yes	the Environment Agency
Yes	the Highways Authority
Yes	all neighbouring local authorities
Yes	other public authorities as appropriate, including UK Health Security Agency and National Highways
Yes	bodies representing local business interests and other organisations as appropriate

4.2 Steering Group

MBC has established a steering group in order to develop the Air Quality Action Plan.

The steering group comprised representatives from

Kent County Council Highways Team

KCC Public Transport Team

KCC Arboriculture Team

MBC Development Management Team

MBC Planning Policy Team

MBC Parking Services Team

MBC Biodiversity and Climate Change Team

Elected Councillors for the ward within the AQMA

Lead member for Environment

The group held a series of meetings between April and December 2022, in order to develop the list of actions to be included in the consultation which was held during December 2022 and January 2023. Following the consultation, the group was convened to discuss the outcomes of the consultation and agree the final actions to be taken forwards. The group will continue to meet quarterly for the life of the action plan to monitor progress and discuss any new actions or modifications to the plan.

5 AQAP Measures

Table 5.1 shows the Maidstone Borough Council AQAP measures. It contains:

- a list of the actions that form part of the plan
- the responsible individual and departments/organisations who will deliver this action
- estimated cost of implementing each action (overall cost and cost to the local authority)
- expected benefit in terms of pollutant emission and/or concentration reduction
- the timescale for implementation
- how progress will be monitored

NB: We have been advised by our AQ consultant, that in most cases, our actions are not suitable for modelling, since this would necessarily have to be based on several assumptions. As we work through the measures in detail, we will make a judgement at that time about whether modelling is possible or worthwhile. In Table 5.1 below, we have estimated the relative size of the impact we expect the measures to have, with three ticks representing the greatest impact, and one tick representing the smallest impact. Please see future ASRs for regular annual updates on implementation of these measures

Table 5.1 – Air Quality Action Plan Measures

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
	Title	Select from the categories in blue box	Select from the subcategories in blue box		Date	Date				Date	
1	Engage with bus service providers to encourage improvement to bus fleet in Maidstone, with special emphasis on services operating on Upper Stone Street	Vehicle Fleet Efficiency	Promoting Low Emission Public Transport	KCC MBC	2024	2025-2028	%of Euro 6 Buses in AQMA	✓✓✓	NA	2028	Current modelling suggests that this measure will almost halve the number of receptors in the AQMA. We will update this modelling in due course to include an up-to-date look at the overall AQMA, and at when compliance with AQ objectives can be expected.
2	Explore expansion of the additional parking restrictions already introduced on Upper Stone Street to include adjacent roads such as Palace Avenue and Knightrider Street	Traffic Management	Parking Enforcement on Highway	MBC	2024	2025-2028	Additional parking restrictions introduced as appropriate	✓	NA	2028	Not possible to model impact of measure as unquantifiable. Would not be a prudent use of scarce resources that could be better spent on implementation of actions.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
3	Review of Air Quality Guidance to reflect updated air quality information via Local Plan Review and Design and Sustainability DPD	Policy Guidance and Development Control	Air Quality Planning and Policy Guidance	MBC	Ongoing	2024 onwards	Local Plan review completed DPD adopted	✓	Local Plan review at advanced stage scheduled to be adopted in late 2023. DPD at rg 19 stage.	End 2024	Not possible to model impact of measure as do not know the outcome of the policy review is. Can be modelled as the action progresses and options are established for consideration by the appropriate committee
4	Review of Taxi Policy	Promotion of Low Emission Transport	Taxi Licensing Conditions	MBC	TBC	2023-2028	Improvement to taxi fleet	✓	NA	2028	Not possible to model impact of measure as do not know the outcome of the policy review is. Can be modelled as the action progresses and options are established for consideration by the appropriate committee
5	Information Campaign to residents of the new AQMA	Public Information	Other	MBC	2024	2024 to 2028	All residents of AQMA have been provided with relevant information on an ongoing basis	✓	NA	2028	Not possible to model impact of measure as unquantifiable. Would not be a prudent use of scarce resources that could be better spent on implementation of actions.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
6	Extension to the Clean Air For Schools (CAFS) programme, with emphasis on roll-out of the Pollution Patrol Resource	Public Information	Via other mechanisms	MBC	Ongoing	Ongoing until 2028	Number of schools signed up to Pollution Patrol in Kent	✓	Approx 50 schools	2028	Not possible to model impact of measure as unquantifiable. Would not be a prudent use of scarce resources that could be better spent on implementation of actions.
7	Prioritise the AQMA and surrounding areas for roll out of new DEFRA funded Health Professionals AQ resource.	Public Information	Via other mechanisms	MBC	Ongoing	2024	Number of health care professionals using the resource	✓	Procurement nearing completion	2028	Not possible to model impact of measure as unquantifiable. Would not be a prudent use of scarce resources that could be better spent on implementation of actions.
8	A campaign of anti-idling signage across the Borough, focussing on schools and other known or identified problem areas	Public Information	Via other mechanisms	MBC	Ongoing	2028	Number of anti-idling signs installed	✓	Approx 20 signs in identified hot spots	2028	Not possible to model impact of measure as unquantifiable. Would not be a prudent use of scarce resources that could be better spent on implementation of actions.
9	Consider discount on resident's parking for EV vehicles.	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	MBC	2024	2025	Council decision on giving discount made	✓	NA	2028	Not possible to model impact of measure as unquantifiable. Would not be a prudent use of scarce resources that could be better spent on implementation of actions.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
10	Review provision of EV parking in Council car parks	Promoting Low Emission Transport	Procuring alternative Refuelling infrastructure to promote Low Emission Vehicles, EV recharging, Gas fuel recharging	MBC	Ongoing	2025-2028	Amount of alternative refuelling provision	✓	NA	2028	Currently provision exceeds demand however this will be kept under review as demand increases.
11	Continuation of MBC sponsorship of the Walk on Wednesday Scheme	Public Information	Via other mechanisms	MBC	Ongoing	Ongoing	Sponsorship continued for life of action plan	✓	£2500 given annually to sponsor scheme	2028	Not possible to model impact of measure as unquantifiable. Would not be a prudent use of scarce resources that could be better spent on implementation of actions.
12	Work with KCC to ensure that potential for appropriate and beneficial tree planting is completed on Upper Stone Street	NA	NA	KCC	Ongoing	Ongoing	Number of trees planted	✓	6 trees planted in suitable location	2028	Not possible to model impact of measure as unquantifiable. Would not be a prudent use of scarce resources that could be better spent on implementation of actions.
13	Identify and bid for any grant funding for suitable projects.	NA	NA	MBC	Ongoing	Dependant on schedule of bid window	Bid submitted	✓	Currently implementing projects from two successful bids	2028	Impact will depend on the nature of each individual project. Modelling on a bid specific basis in support.

Measure No.	Measure	EU Category	EU Classification	Lead Authority	Planning Phase	Implementation Phase	Key Performance Indicator	Target Pollution Reduction in the AQMA	Progress to Date	Estimated Completion Date	Comments
14	Explore the use of new and novel solutions that may to reduce the impact of pollution on Upper Stone Street	NA	NA	MBC	Ongoing	Ongoing	Novel solutions considered as appropriate	✓	One considered to date “roadvent”	2028	Roadvent project considered but difficulties around installation and ongoing operational costs could not be resolved.

Appendix A: Response to Consultation

ABSTRACT

Contents

Introduction

Air Quality Action Plans are the mechanism by which local authorities, in collaboration with national agencies and others, state their intentions for working towards air quality objectives through the use of the powers they have available.

A draft Air Quality Action Plan (AQAP) was produced in September 2022 as part of the Council's duty to improve local air quality. It outlines the actions MBC will undertake to improve air quality in the borough between 2023 and 2028.

Methodology

Maidstone Borough Council undertook a consultation between 28 November 2022 and 29 January 2023.

The survey was carried out online with a direct email to those on the Council's consultation mailing list. It was also promoted through the Council's social media channels. Paper copies of the survey and alternative formats were available on request. The survey was open to all Maidstone Borough residents aged 18 years and over and visitors to the borough.

Respondents were asked their opinions about the proposed actions for the Air Quality Management Plan. There was opportunity throughout to provide additional comments.

There was a total of 471 responses to the survey and a letter commenting on the proposed actions was received from KCC (attached at Appendix A).

The data has not been weighted; however, the bottom two age brackets were combined to create the 18 to 34 years group. Please note not every respondent answered every question; therefore, the total number of respondents, refers to the number of respondents for that question, not to the survey overall. Comments have been categorised according to content with some covering more than one category.

Transport Measures

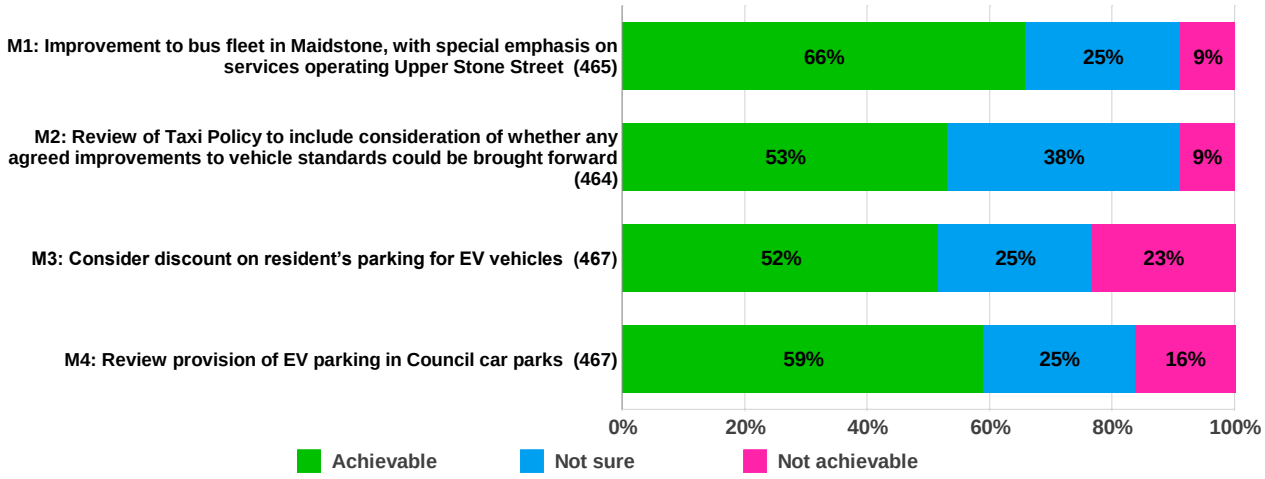
Achievability of Transport Measures

Respondents were asked to review the proposed transport measures and were asked if they were achievable or not.

A total of 467 respondents answered these questions.

Overall, Measure 1, 'Improvement to bus fleet in Maidstone, with special emphasis on services operating Upper Stone Street' was considered to be the most achievable with 66% responding this way.

Measure 3, 'Consider discount on resident's parking for EV' was considered the least achievable with the greatest proportion answering 'not achievable' across the transport measures. 23% of respondents answered this way and the lowest proportion stating it was achievable at 52%.



Demographic Differences

The data showed that there was a greater proportion of male respondents that felt Measure 3, 'consider discount on resident's parking for EV vehicles' was unachievable with 27% compared to 18% of female respondents.

Male respondents also had a greater proportion than female respondents that answered, Measure 4, 'review provision of EV parking in council car parks' was unachievable with 19% answering this way compared to 12% of female respondents.

Additional Comments

Respondents that said that a measure was unachievable, were prompted to explain why they felt this way. The comments are set out, by question, in the tables below:

M1: Improvement to bus fleet in Maidstone, with special emphasis on services operating Upper Stone Street (40 Comments)		
Theme	**No.**	**Nature**
Traffic Flow	9	A bypass is needed. Redirect traffic from Upper Stone Street. Stationary traffic is the issue.
Public Transport doesn't meet needs	8	Bus services have been cut and services have been reduced. Services are unreliable. Will only work if there are dedicated bus lanes.
Cost	6	Who will pay for improvements to the fleet? Too expensive.
Little or no impact	6	Unconvinced measure will result in improvements to air quality. Buses have to use this route. Buses are in the minority of vehicles on the roads.
No control	6	The Council has no control over private bus fleet operators.
P&R	3	Condemnation over the cutting of P&R services.
Environmentally Friendly Buses	3	Why not hydrogen cell yet? Make all buses hydrogen or electric.
Other	2	Bring back trolly buses. Stop buses from idling.

M2: Review of Taxi Policy to include consideration of whether any agreed improvements to vehicle standards could be brought forward (34 Comments)		
Theme	**No.**	**Nature**
Impact on taxi drivers	18	Would make running a taxi unviable. Unfair on taxi operators. New EV Taxis are expensive.
Little or no impact	5	Taxis are not the issue. Taxis already at a high standard.
Cost of living/Cost of fares	4	This policy should not be brought forward as people are already struggling with the cost-of-living crisis. This will result in increased fares for taxi users.
Electric Vehicles	3	Need electric taxis. No infrastructure for electric vehicles. Issues recycling lithium batteries.
Other	3	This is outside the Council's remit. Taxi standards have declined (vehicles & driver skills). The technology is not available to implement this measure.
Uber	2	Will this include Uber drivers' vehicles? Invention of Uber means this can not be regulated.

M3: Consider discount on resident's parking for EV vehicles (99 Comments)		
Theme	**No.**	**Nature**
Unfair	34	This measure is unfair and discriminates against those who cannot have EVs. EV owners should not get any special treatment.
EV Expense	26	EVs are expensive.

M3: Consider discount on resident's parking for EV vehicles (99 Comments)		
Theme	**No.**	**Nature**
		Majority of people cannot afford to buy an EV.
Space issues	9	Resident parking is at a premium. This will not improve situation as still more cars than spaces. There is not currently enough resident on-street parking.
Impact on Council finances	9	Waste of money as bigger priorities. Uncollected money is a lost for the Council. Council cannot afford to lose the revenue.
Too soon for EV	9	Wait five years for this measure when EVs will have improved (and more people have them). Electric shortages expected this year. Issues with recycling/disposing of EV batteries still need to be resolved.
Little to no impact	8	All vehicles pollute in some way (brake dust and rubber) and take up the same space. Measure does not meaningfully incentivise EV take up. Amount of EV vehicles too small to make an impact.
EV Infrastructure	6	Cost of installation will not be recoverable for several years. This measure will cost too much to implement. Wider infrastructure for EVs still requires investment to make it a viable alternative to petrol.
Traffic & Traffic Flow	3	Would be better addressing pinch point in traffic and improving/changing the one-way system. Queuing traffic/congestion needs to be addressed.
Parking charges	2	Should not have to pay to park outside your own house.
Other	2	Should be encouraging mode changes. Government has introduced road tax for EV due to loss of revenue.

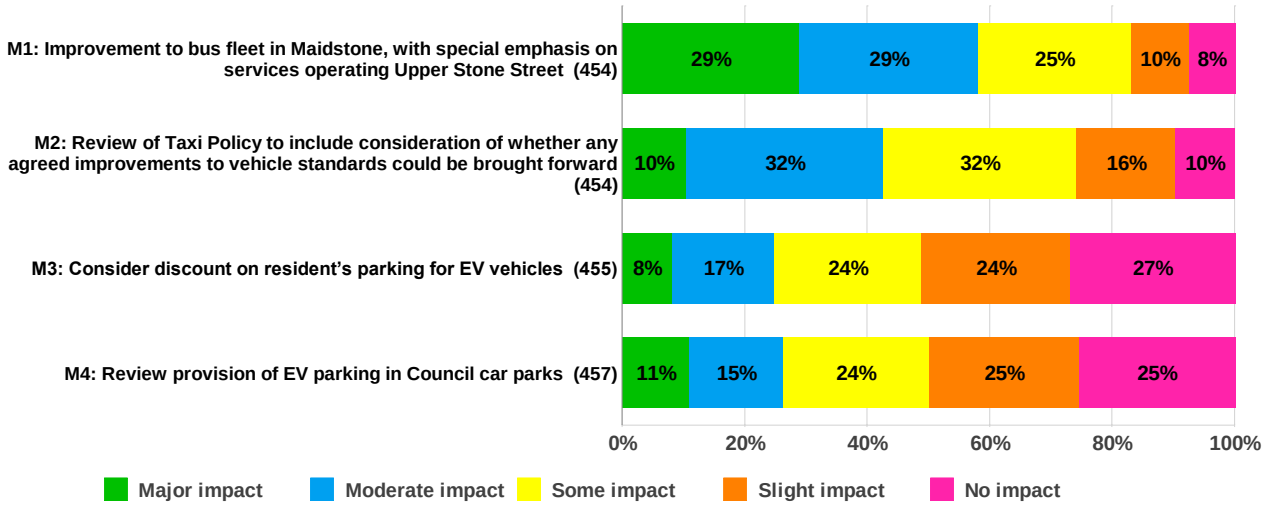
M4: Review provision of EV parking in Council car parks (63 Comments)		
Theme	**No.**	**Nature**
Unfair	25	Creates preference system – EV owners should pay the same as everyone else. Unfair for EV owners to get special treatment.
Limited parking	15	Already a shortage of parking spaces. Current EV spaces not used.
EV Infrastructure	9	This measure is too expensive. There is a lack of wider infrastructure to support EVs.
Little to no impact	9	EVs still cause pollution (displaced to manufacturing process). Improvements to air quality arising from this measure likely to be negligible. EVs are in the minority of vehicles.
Other priorities	4	There currently are more important issues for MBCs budget than implementing this measure.
Deters visitors to Maidstone	4	Implementing this measure would deter people from visiting Maidstone. People will shop elsewhere if they cannot park.
Other	3	EVs expensive.

		Vandalism would be an issue. EVs need long periods to charge (short charges impact on battery life).
Traffic Flow	2	Improve traffic flow by removing traffic lights and improving one-way system. Introduce enforceable speed limit for HGVs going through Harrietsham.

Impact of Transport Measure

Respondents were asked to indicate what impact they thought each of the measures would have on air quality locally.

A total of 457 respondents answered these questions. Overall, respondents felt that Measure 1: Improvement to bus fleet in Maidstone, with special emphasis on services operating Upper Stone Street, would have the greatest impact. 59% of respondents said that this would have a Major or Moderate impact. Respondents felt that Measure 3 Consider discount on resident's parking for EV vehicles would have the least impact with 51% responding that this measure would have a slight impact or no impact.



Demographic Differences

The data show that a greater proportion of female respondents felt that measure 1: Improvement to bus fleet in Maidstone, with special emphasis on services operating Upper Stone Street, would have a major or moderate impact on air quality locally with 64% answering this way compared to 54% of male respondents.

There were no respondents aged 18 to 34 years that said that Measure 3: Consider discount on resident's parking for EV vehicles, or Measure 4: Review provision of EV parking in Council car parks, would have a major of moderate impact.

A greater proportion of male respondents answered slight or no impact when asked about measure 3 with 57% responding this way compared to 42% of female respondents.

Male respondents also had a greater proportion responding slight or no impact when asked about measure 4 with 56% responding this way compared to 41% of female respondents.

Transport Measures General Comments

All respondents were given the opportunity to provide additional comments about the proposed Transport measures, a total of 172 comments were received.

Transport General Comments		
Theme	**No.**	**Nature**
Traffic Flow & Management	57	Congestion is the main issue. Remove traffic lights and create a bypass to improve air quality in the Town Centre. Create a Clean Air Zone. Prevent and enforce idling (Taxis and Busses in High Street).
Public Transport	48	Update all the buses. Improve public transport – cheaper and more frequent services. Make public transport more attractive to people.
EV Vehicles	36	EVs are expensive - financial incentives to buy could help take-up. Counterproductive – electricity is not generated in an environmentally friendly way. EVs are in the minority of vehicles on the roads. More Council charging points needed.
P&R	20	Bring back the P&R service. P&R will reduce the number of vehicles in the Town centre.
Active Travel	16	More bicycle lanes and secure storage in the Town centre. Encourage cycling with safe (& segregated routes). Improvement pavements.
Little to no impact	16	Trivial measures that will only have a marginal impact. These measures do not go far enough and will not impact pollution.
HGVs	11	Divert HGVs from the Town centre. Restrict HGVs traveling through Town. HGVs are the biggest polluters.
Development	9	Development has increased the number of vehicles on roads. Development is not supported by road and highways infrastructure upgrades. Stop building so many new homes.
Other Comments	5	Do not reduce the AQMA. Do not penalise petrol vehicle users. Protect green spaces. Measure would impact on Council revenues. Too many people are the real cause of pollution.

Transport General Comments		
Theme	**No.**	**Nature**
Behaviour Shift	4	Need more meaningful measures to facilitate a behaviour shift from private vehicles.
Other Areas	3	Upper Stone Street is not the only area of concern. These measures only relate to the Town Centre rather than villages.
More detail	3	Requests for more details on the proposed measures.
Suggestions	2	Introduce charges for commercial vehicles parking overnight. Remove all diesel vehicles registered before 2016.

Information & Education Measures

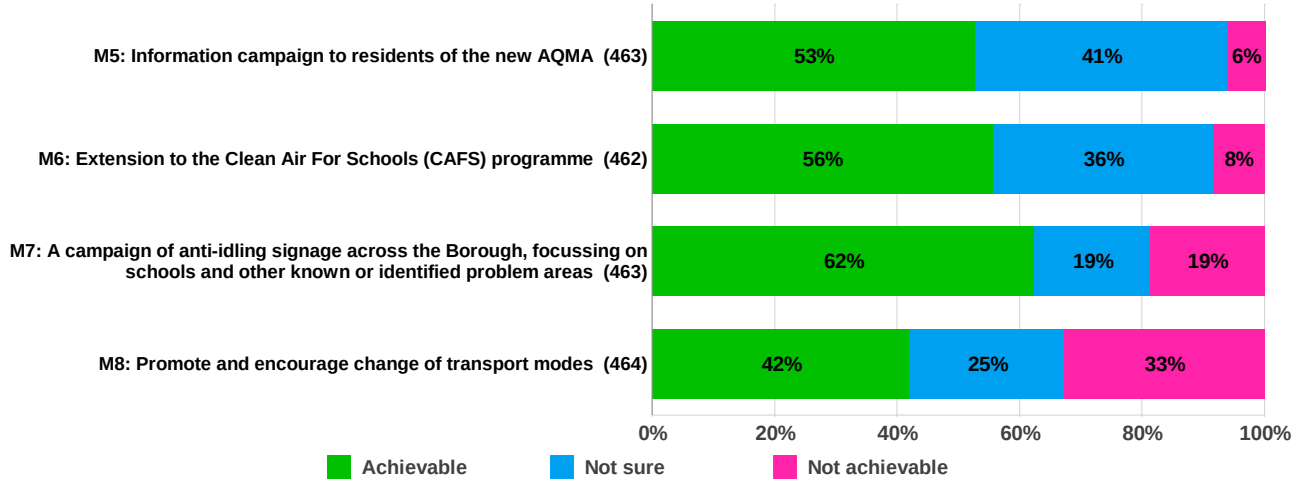
Achievability of Information & Education Measures

Respondents were asked to review the proposed information and education measures and were asked if they were achievable or not.

A total of 464 answered these questions.

Overall, Measure 7, 'A campaign of anti-idling signage across the Borough, focussing on schools and other known or identified problem areas' was considered the most achievable with 62% responding this way.

Measure 8, 'Promote and encourage change of transport modes' was considered the least achievable with the greatest proportion of respondents answering 'not achievable' across the information and education measures with 33% answering this way and the lowest proportion stating it was achievable at 42%.



Demographic Differences

The data showed a greater proportion of female respondents felt that Measure 6, 'Extension to the Clean Air for Schools (CAFS) programme' was achievable with 62% answering this way compared to 51% of male respondents.

Respondents aged 18 to 34 years had the greatest proportion, across the age groups, that said Measure 6 was unachievable with 29% responding this way.
A greater proportion of female respondents answered that Measure 7, 'A campaign of anti-idling signage across the Borough, focussing on schools and other known or identified problem areas' was achievable with 71% answering this way compared to 58% of male respondents.

A greater proportion of respondents from minority groups felt that Measure 8 'Promote and encourage change of transport modes' was achievable with 67% answering this way compared to 41% of respondents from white groups.

A greater proportion of female respondents answered that Measure 8 was achievable with 49% answering this way compared to 37% of male respondents.

Additional Comments

Respondents that said that a measure was unachievable, were prompted to explain why they felt this way. The comments are set out, by question, in the tables below:

M5: Information campaign to residents of the new AQMA (22 Comments)		
Theme	**No.**	**Nature**
Little to no impact	12	People don't pay attention to these campaigns. Will not change behaviour. People don't care about air quality.
Cost	7	This measure is a waste on money. This measure is too expensive.
Other	5	People will still need to get from A to B. The general public do not take their responsibility towards air quality seriously. EV infrastructure is not available yet.

M6: Extension to the Clean Air For Schools (CAFS) programme		
Theme	**No.**	**Nature**
Ignored	15	This measure will not have any impact as it will be ignored.
Cost	5	Don't waste money on pointless campaigns.
Discriminatory	4	This measure would be discrimination – people who don't have children and those that cannot afford EVs.
Logistics	3	Children do not live locally /in walking distance of their schools. Public transport is too unreliable for school transport.
Other	3	Stop making people use EVs. Areas of high pollution- around the Montessori School & Tonbridge Road (by College).
Enforcement	2	MBC can't enforce this. Schools can't enforce this.

M7: A campaign of anti-idling signage across the Borough, focussing on schools and other known or identified problem areas		
Theme	**No.**	**Nature**
Ignored/Little to no impact	39	Will be ignored - particularly in cold and wet weather. Signage alone will make no difference and will be ignored. This measure is not significant enough to make a difference to air quality.
Enforcement	16	Without sanctions this is waste of money. This needs proper enforcement to work. This cannot be enforced.

M7: A campaign of anti-idling signage across the Borough, focussing on schools and other known or identified problem areas		
Theme	**No.**	**Nature**
Traffic	14	The high volume of traffic on Maidstone's roads makes this measure ineffective. Structure of road system and network causing pollution. Improve traffic lights. Constant roadworks cause congestion.
Cost	9	This is a waste of money. Money for signs could be better spent elsewhere.
Newer vs Older vehicles	8	Many newer vehicles have automatic cut outs. Idling only an issue with older vehicles (and not everyone can afford to upgrade).
Other	4	Discourage people driving to schools. This aims to restrict movement and move to hybrid learning under the guise of climate change. Maidstone does little for pedestrians who are the most at risk of poor air quality.

M8: Promote and encourage change of transport modes (141 Comments)		
Theme	**No.**	**Nature**
Public transport	73	Public transport is unreliable and expensive. Many places do not have bus services. Bring back the P&R service. Bus services are being cut.
Behaviour change/Car Reliant	42	Cars are the only options – alternative are not viable. The car is the most convenient way to travel in Maidstone. Behaviour change impractical for many.
Active transport	17	More cycle lanes and footpaths away from roads needed. Older demographic unable to walk or cycle. Feels unsafe cycling in Maidstone.
EVs	10	EVs are too expensive for most – more purchase incentives required. EV charging network needs work.
Impact	9	Without enforcement or penalties measure will be ignored. The Council has no control in this area. Measure will have minimal impact on air quality.
Traffic & Traffic Management	7	Road are not big enough (and no space for trams or trolly buses). Need alternative routes to south of the Borough that bypass the town centre.
Development	6	Too many homes being built. New housing development are not served by public transport. Infrastructure has not kept up with development.
Cost	5	This is a waste of money. This measure would be expensive to implement. There are no available funds to support this measure.
Other	3	Need to set harder targets. Need more data on people modes of transport and journeys.

		Run a school's bus service like in America.

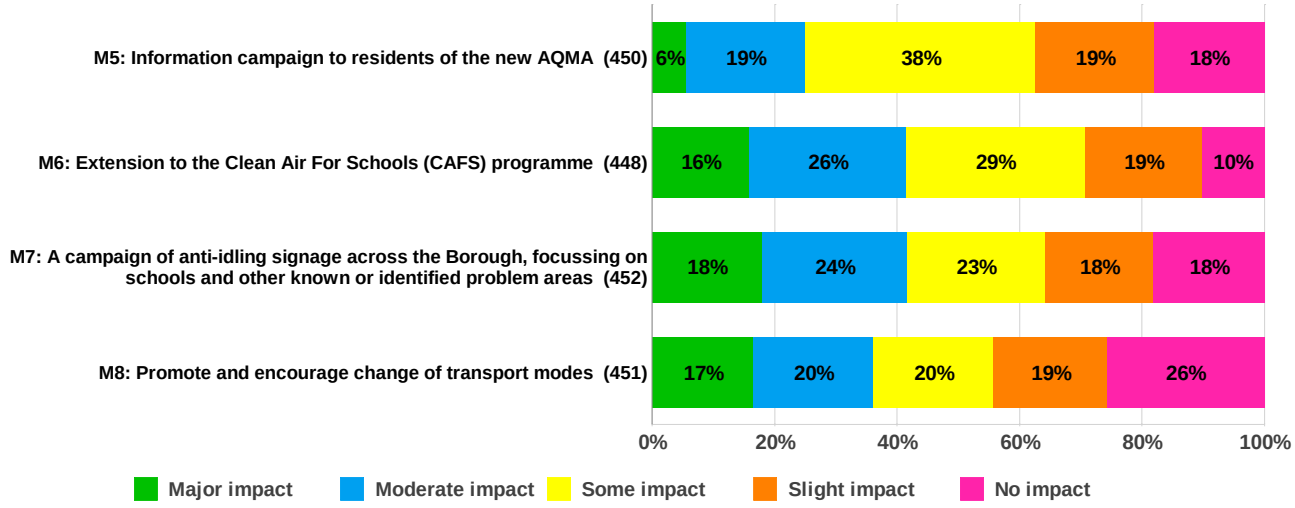
Impact of Information & Education Measures

Respondents were asked to indicate what impact they felt each of the measures would have on air quality locally.

A total of 458 respondents answered these questions.

Overall, respondents felt that Measure 7: A campaign of anti-idling signage across the Borough, focussing on schools and other known or identified problem areas would have the greatest impact with 42% responding Major or Moderate impact.

Respondents felt that Measure 8: Promote and encourage change of transport modes would have the least impact with 44% responding that this measure would have a slight impact or no impact.



Demographic Differences

The data show that a greater proportion of male respondents felt that measure 5: Information campaign to residents of the new AQMA, would have a only a slight impact or no impact on air quality locally with 43% answering this way compared to 28% of female respondents.

A greater proportion of female respondents felt that measure 6: Extension to the Clean Air For Schools (CAFS) programme, would have a only a major or moderate impact on air quality locally with 53% answering this way compared to 35% of male respondents.

A greater proportion of male respondents responded slight or no impact when asked about measure 7 with 42% responding this way compared to 26% of female respondents.

A greater proportion of male respondents responded slight or no impact when asked about measure 8 with 51% responding this way compared to 32% of female respondents.

Information & Education General Comments

All respondents were given the opportunity to provide additional comments about the proposed Information & Education measures, a total of 115 comments were received.

Information & Education Measures Additional Comments		
Theme	**No.**	**Nature**
Impact	22	Measures are a waste of time and money. Promotion and encouragement will not be enough to get people on board. Measures will be ignored unless enforced. Measure will have little impact on air quality.
Schools Transport	20	Schools traffic is a significant contributor to air quality and congestion in Maidstone. Most children live too far away from their school to walk to cycle. Walking & cycling in some rural areas is dangerous for children. Cycling classes in schools would help normalise cycling. Encourage schools to encourage their pupils to use active transport methods and public transport.
Traffic	19	Focus on improving traffic flow. Review traffic lights to reducing queuing. Maidstone needs a by-pass or ring road.
Idling	17	Anti-idling signage will not work unless it is enforced. Anti-idling should apply to buses and HGVs. Anti-idling campaigns around schools should be wider than just the road that the school is on.
Behaviour	11	Promote car sharing and travelling off-peak. Measures need to be easy to achieve or they will be ignored. Behaviour changes difficult without incentives and sanctions.
Active Transport	7	Maidstone is walkable but pedestrians are exposed to high levels of pollution. Improve provisions for cycling. Promote cycling and walking.
EVs	7	EVs are not affordable for most residents. Do more to support residents change to EV by supporting resident to install or installing EV chargers on residential streets.
Air Quality Data	7	More information requested on details of the proposals. Data being used to evidence AQMA is flawed.
Park & Ride	6	Should not have cut the P&R services.
Car Alternatives	6	There are no alternatives that are as convenient or cost effective as travelling by car.
Suggestions	5	More tree and bushes. Scrappage grants for older and diesel vehicles.

Information & Education Measures Additional Comments		
Theme	**No.**	**Nature**
		Consider electric scooters (subject to standards) as an alternative mode of transport (particularly for school children). Use of smaller vans and commercial vehicles at peak times (Ashford model).
Development	4	Extra vehicles on the town's roads are due to extensive house building in the borough. Development has created out of town estates that are reliant on the car.
Other	3	No backdoor taxation for road users. Wood burning stoves contribute to poor air quality. Lobby for top tier authorities with highways responsibilities to be responsible for AQMAs.

Miscellaneous Measures

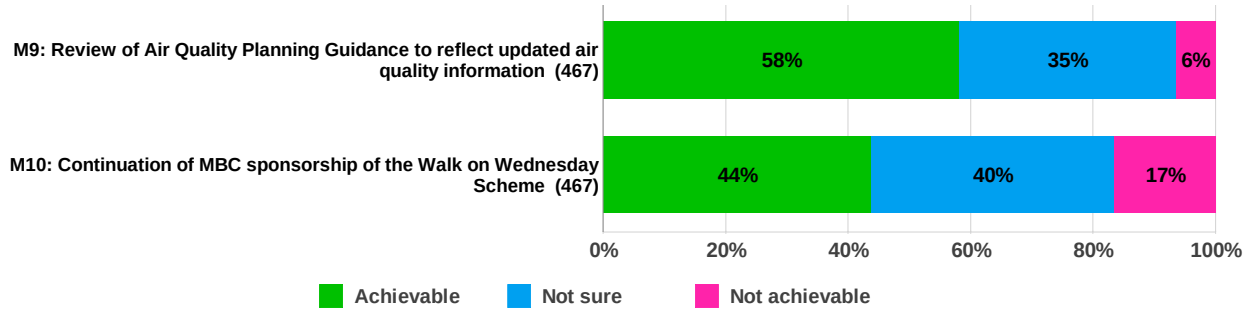
Achievability of Miscellaneous Measures

Respondents were asked to review the proposed transport measures and were asked if they were achievable or not.

A total of 467 answered these questions.

Overall, Measure 9, 'Review of Air Quality Planning Guidance to reflect updated air quality information' was considered the most achievable with 58% responding this way.

Measure 10, 'Continuation of MBC sponsorship of the Walk on Wednesday' was considered less achievable with 17% answering this way.



Demographic Differences

29% of Respondents aged 18 to 34 years said that Measure 9 'Review of Air Quality Planning Guidance to reflect updated air quality information' was unachievable, the highest response across all age groups.

A greater proportion of respondents from minority groups felt that Measure 9 was achievable with 83% answering this way compared to 58% of respondents from white groups.

Additional Comments

Respondents that said that a measure was unachievable, were prompted to explain why they felt this way. The comments are set out, by question, in the tables below:

M9: Review of Air Quality Planning Guidance to reflect updated air quality information (24 Comments)		
Theme	**No.**	**Nature**
Impact	14	A review will make difference. People have to rely on their cars so traffic will not be reduced.
Development	3	Development has lacked transport infrastructure. Planning doesn't care about environmental issues.
Costs	2	This measure is too expensive. This measure needs more investment.
Other	2	Should not have cut P&R. Do not support the 'Great Reset'.
Data	1	More information needed to make an informed decision.
Suggestions	1	Plant more trees. Subsidies for EVs.
Traffic	1	Sort out the one-way system.
M10: Continuation of MBC sponsorship of the Walk on Wednesday Scheme (75 Comments)		
Theme	**No.**	**Nature**
Impractical	18	People live too far away to walk to work/school. Not everybody can walk. People don't want to walk in poor weather/in the dark. Shopping locations out of town require a car for access and carrying goods.
Unaware of walk on Wednesday scheme	17	What is Walk on Wednesday? Unaware of this scheme.
Impact	17	This will be ignored. This measure will have minimal impact (particularly in the Lower Stone Street area). This will not impact on congestion. Impact would be greater if walking scheme was more than one day a week.
Waste of money	11	This measure is a waste of money.
Behaviours	8	People are unlikely to take part – will continue to use preferred method of transport.
Active travel	6	Cycling and walking are unsafe. There is a lack of cycle lanes/paths. Footpaths are narrow, overgrown and are dirty.
Other	3	Sort out the one-way system. Do not support the 'Great Reset'. Bus services being cut and no routes in rural areas.
Development	1	Nothing about reducing emissions from development.

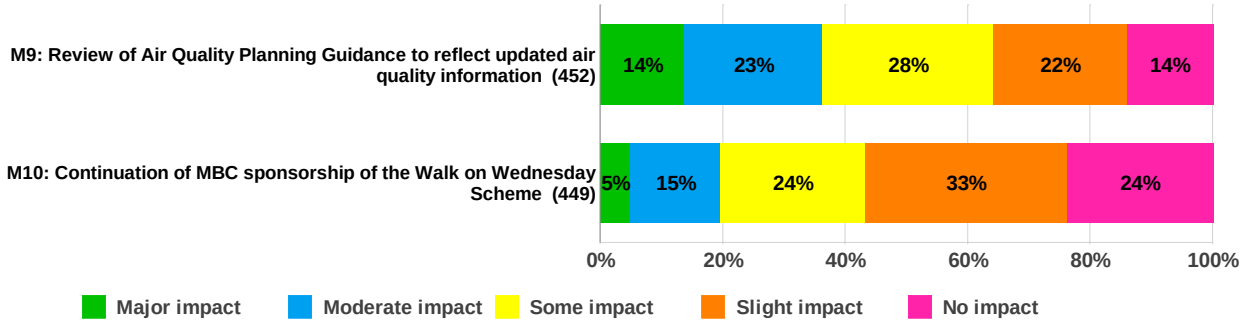
Impact of Miscellaneous Measures

Respondents were asked to indicate what impact they thought each of the measures would have on air quality locally.

A total of 452 respondents answered these questions.

Overall, respondents felt that Measure 9: Review of Air Quality Planning Guidance to reflect updated air quality information would have the greatest impact with 37% responding Major or Moderate impact. However, only a marginally lower proportion said that this measure would have a slight impact or not impact with 36% answering this way.

More than half of all respondents felt that Measure 10: Continuation of MBC sponsorship of the Walk on Wednesday Scheme would have a slight impact or no impact at all with 57% answering this way.



Demographic Differences

43% of female respondents felt that measure 9: Review of Air Quality Planning guidance to reflect updated air quality information, would have a major or moderate impact on air quality compared to 32% of male respondents.

66% of male respondents responding slight or no impact when asked about measure 10: Continuation of the MBC sponsorship of the walk on Wednesday Scheme compared to 44% of female respondents.

Miscellaneous Measures General Comments

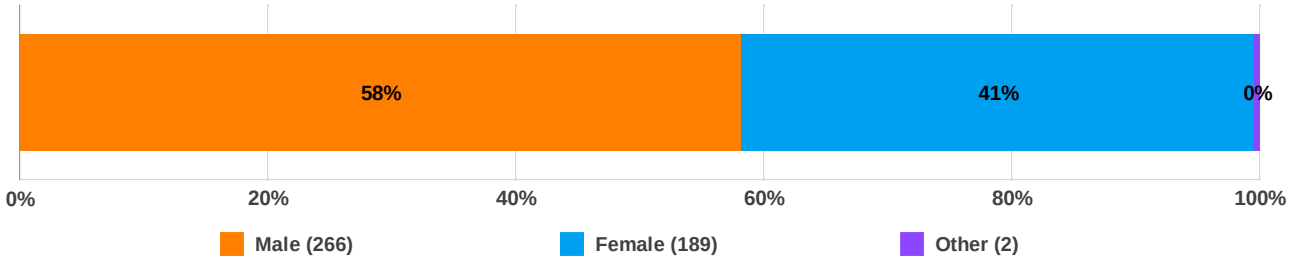
All respondents were given the opportunity to provide additional comments about the proposed Miscellaneous measures, a total of 94 comments were received.

Miscellaneous Measures Additional Comments		
Theme	**No.**	**Nature**
Walking Scheme	32	Never heard of the Walk on Wednesday scheme. People who want to walk already do.
Suggestions	16	Plant more trees.

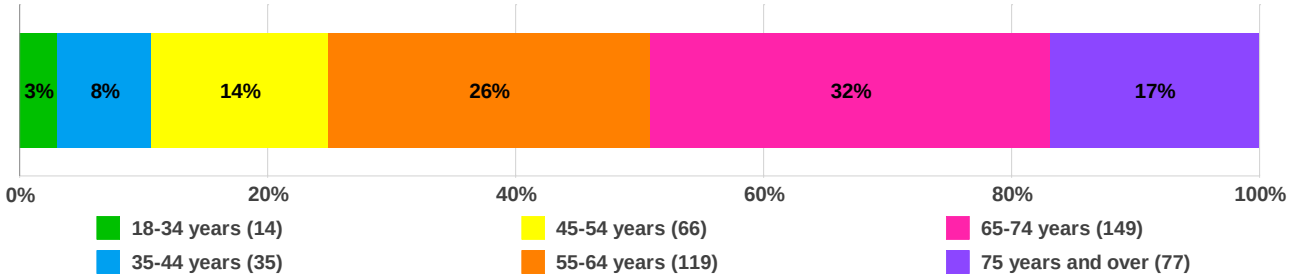
Miscellaneous Measures Additional Comments		
Theme	**No.**	**Nature**
		Increase parking charges to discourage car use. Introduce stopping restrictions outside of schools and low traffic neighbourhoods. Promote walking buses and car sharing. Incentivise walking through trough CT discount. Link AQMA to Sustainability DPDs. Introduce a congestion charge. Look at installing City Trees (Wandsworth LA example). More cycle paths.
Impact	13	Measures will have little impact. Achievability of measure depends on will of the Council.
Development	13	Build fewer homes. Development should be designed to encourage walking. Travel infrastructure has not kept up with the speed of house building. This will slow down housing delivery.
Public Transport	12	Reinstate P&R. Buses do not cover all areas of the borough. Public transport needs to improve.
Traffic	11	Concentrate on reducing congestion and improving traffic flow. Improve the one-way system. Review traffic lights to target traffic flow at pollution hotspots. Remove traffic from the town centre.
Safety	5	Need safer bus shelters. Need safe cycle routes. Consider pedestrian safety (uneven & narrow pavements, appropriate crossing points). EV scooters on pavements are a safety issue.
Other	5	Unable to give an opinion further information needed. Wood burning stoves need to be addressed. Will Parish Councils be able to request air monitoring if they feel there is a need? Do not support the 'Great Reset'.
EVs	2	Charging points need to be reliable and maintained. Implications needed for non-electric vehicles using bays designated for EVs (i.e., those with chargers).

Demographics

Gender



Age



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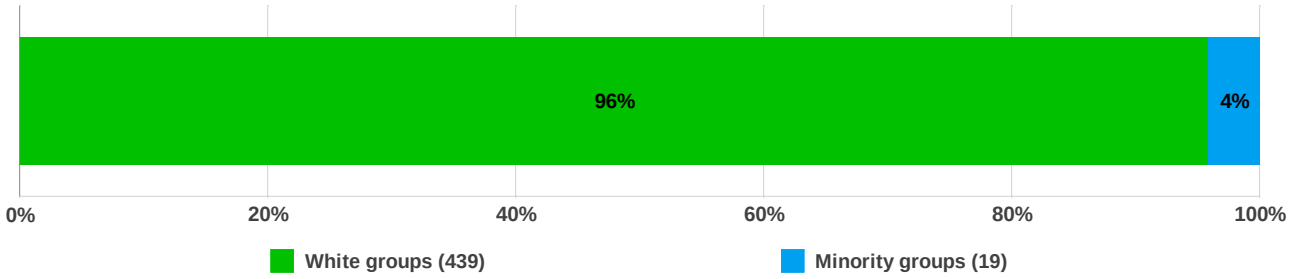
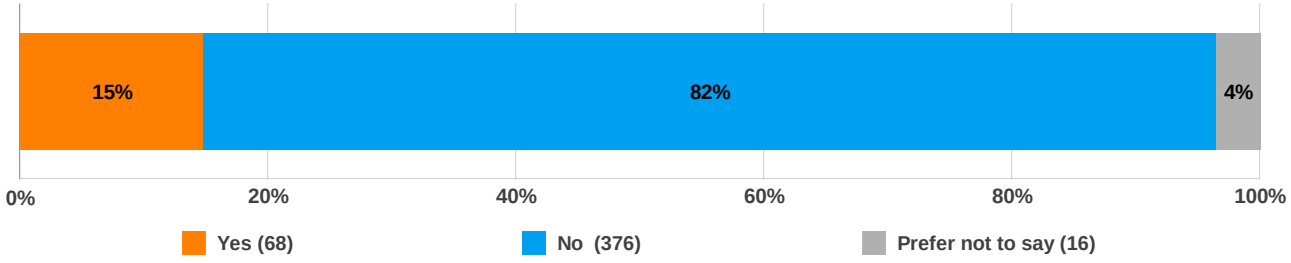


Disability



Appendix B: Reasons for Not Pursuing Action Plan Measures

None of the measures that were considered have been excluded.

Appendix C: Review of AQMA

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Maidstone Borough Council

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1 Introduction

1.1 Maidstone Borough Council (MBC) declared an Air Quality Management Area (AQMA) for the annual mean nitrogen dioxide objective in 2008, encompassing the entire Maidstone conurbation. This AQMA was reduced in size in 2018, and now covers the majority of roads within the Maidstone urban area.

1.2 This report sets out a review of the AQMA in Maidstone, to determine compliance with the annual mean air quality objective for nitrogen dioxide. The review has been undertaken with a view to reducing the size of the AQMA. As outlined in the 2020 Annual Status Report (ASR) (Maidstone Borough Council, 2020), MBC believes that compliance has already been achieved in the majority of the area, and that there is scope for revoking the AQMA in its current form and declaring a smaller AQMA.

1.3 Initially, the monitoring data within the AQMA has been reviewed, along with the locations of relevant exposure, which have been used to define the locations that require detailed modelling. The review considers data from the network of nitrogen dioxide diffusion tubes and automatic monitoring sites operated by MBC.

1.4 Detailed modelling of the area of interest has been undertaken for a baseline year (2019) to inform the extent of the proposed new AQMA. A future year (2022) has also been modelled to predict changes in nitrogen dioxide concentrations in the study area over time, without intervention to reduce traffic emissions. Two future scenarios, in which all buses comply with the Euro VI emission standard, and in which all buses are converted to electric vehicles, have also been tested to assess the impacts of these hypothetical scenarios on concentrations in the study area.

1.5 This report has been carried out by Air Quality Consultants Ltd (AQC) on behalf of MBC. It has been prepared taking account of the requirements set out in LAQM.TG(16) (Defra, 2021a) for amending or revoking AQMA orders. The professional experience of the consultants who have undertaken the review is summarised in Appendix 0.

2 Review of AQMA

2.1 Monitoring sites within Maidstone are shown in **Figure 1**. Three distinctive areas of focus have been selected for analysis ('M20 and North Maidstone', 'Barming and West Maidstone' and 'Central Maidstone and the A229'). Each distinct area of the AQMA has been reviewed and overall conclusions drawn.

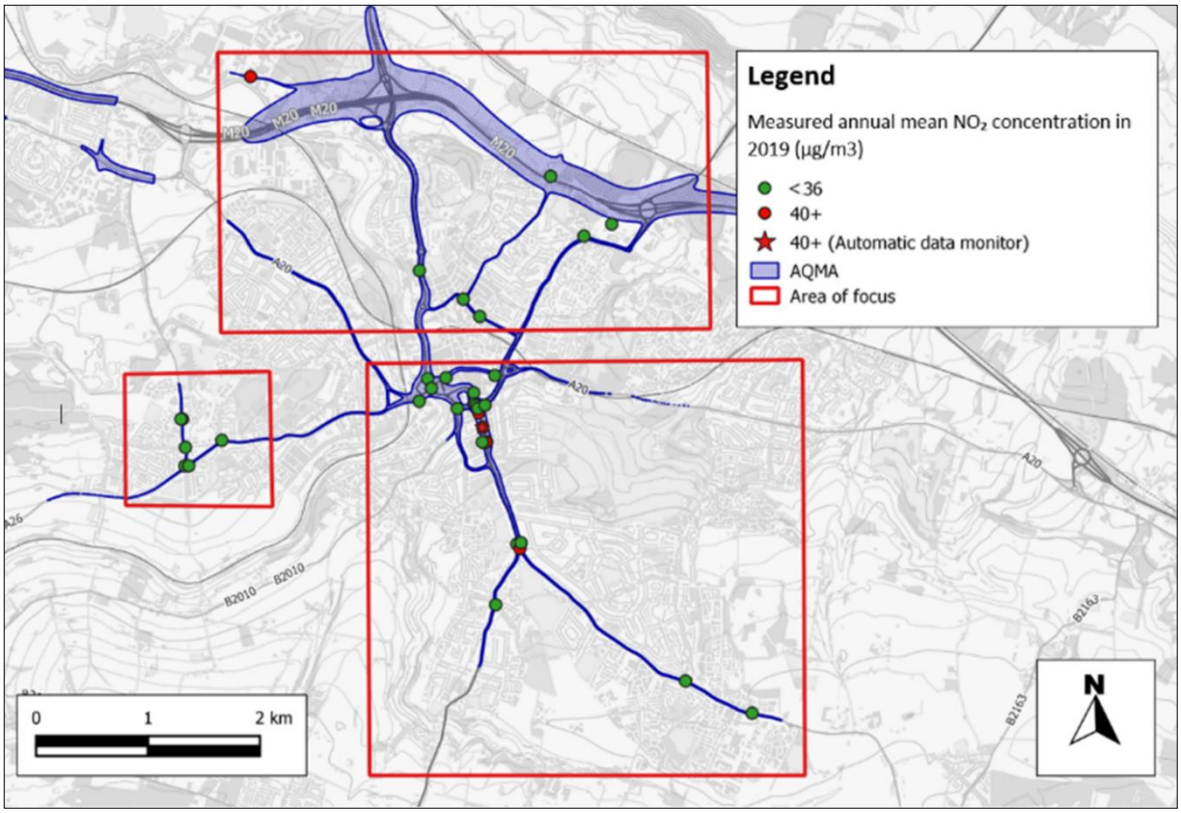

Figure 1: AQMA and Areas of Focus in Maidstone Borough Council

2.2 The following sections present monitoring data for each area of the AQMA highlighted in **Figure 1**.

M20 and North Maidstone

2.3 Monitoring is carried out using diffusion tubes at seven locations in the north of Maidstone (see **Figure 2**). The monitoring locations are representative of worst-case exposure in the AQMA, being installed next to some of the busiest roads in the area.

2.4 As shown in **Figure 3** and **Table 2**, there is a downward trend in concentrations of annual mean nitrogen dioxide between 2016 and 2020 adjacent to the M20 and in North Maidstone. At all

locations except monitor Maid116, concentrations have been below the objective in 2017, 2018, 2019, and less than 90% of the objective in 2019 and 2020.

2.5 Exceedances of the annual mean objective have been measured at monitor Maid116 every year since monitoring commenced at that location in 2017. This monitor is located on a telegraph pole 1 m from the kerb of Forstal Road, 4.3 m from the façade of Forstal Road Cottages (the closest location of relevant exposure). In 2019 and 2020, once distance corrected to the façade of the property, the objective was achieved at monitor Maid116 (37.6 µg/m^3 and 31.6 µg/m^3, respectively) and in 2018 the objective was just achieved (calculated to be 40 µg/m^3 at the façade).

2.6 In early 2020, activity in the UK was disrupted by the COVID-19 pandemic. As a result, concentrations of traffic-related air pollutants fell appreciably (Defra Air Quality Expert Group, 2020). While the pandemic may cause long-lasting changes to travel activity patterns, it is reasonable to expect a return to more typical activity levels in the future. It is thus likely that 2020 presents as an atypically low pollution year for roadside pollutant concentrations, as will 2021.

2.7 While 2020 was not a representative year, considering the recent trends in the monitoring data, is it recommended the AQMA is revoked in northern Maidstone and this area of the M20, including at Forstal. It is recommended that, if practical, a diffusion tube is located on one of the Forstal Road Cottages to ensure compliance. However, it is considered that façade concentrations are likely to reduce further in future years and exceedances are unlikely.

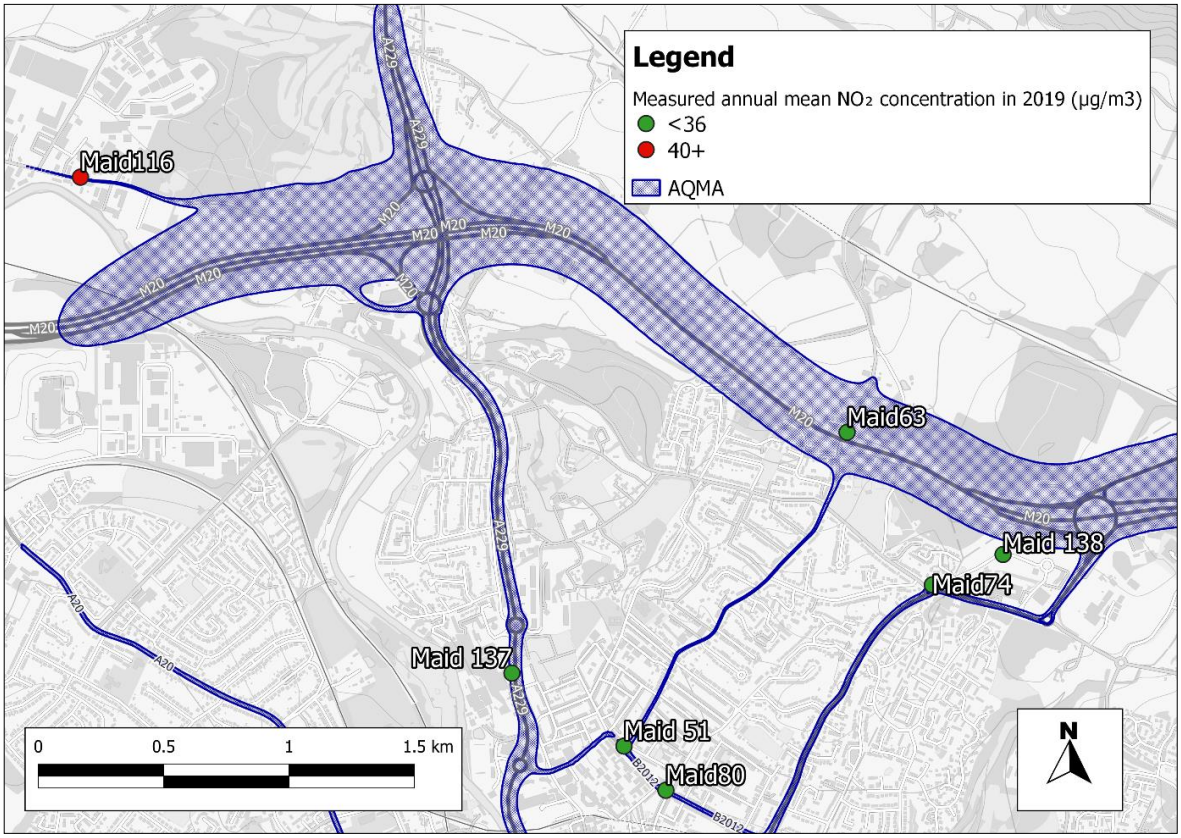

Figure 2: Air Quality Monitoring along the M20 and North Maidstone

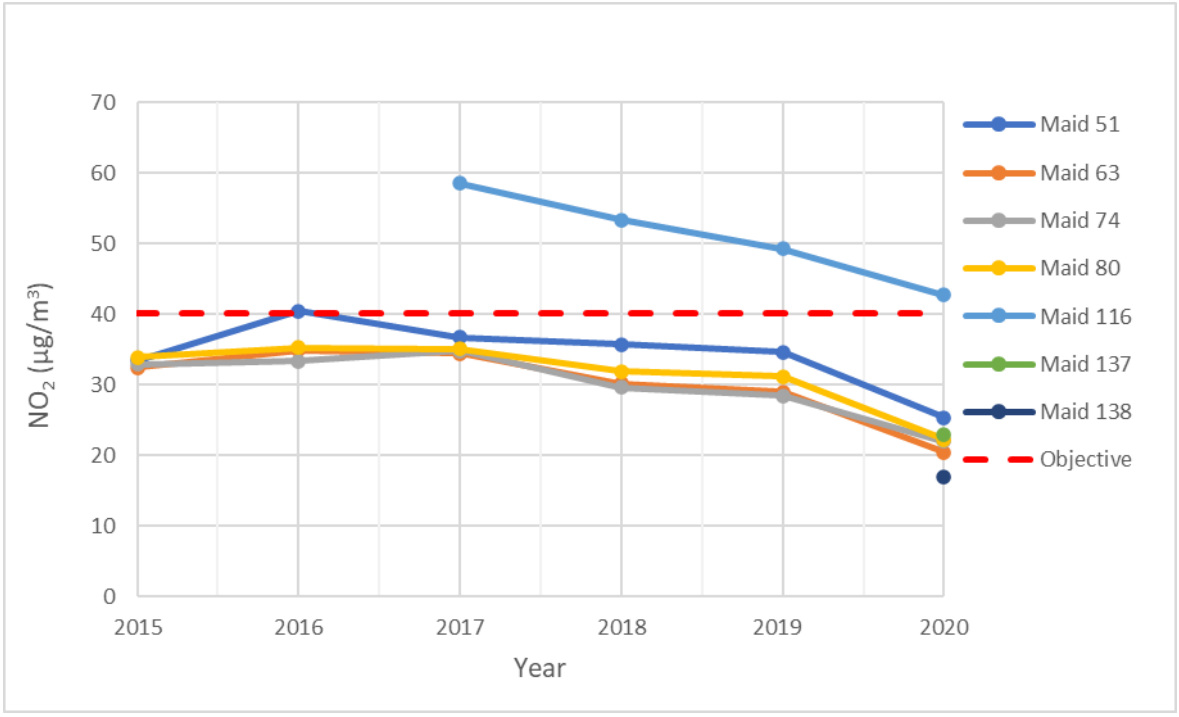

Figure 3: **Annual Mean NO_2 at Diffusion Tube Monitoring Sites along the M20 and in North Maidstone**

Table 2: **Summary of Annual Mean Nitrogen Dioxide Monitoring (2016-2020) along the M20 and in North Maidstone (µg/m^3) [a]**

Site	Site Type	Location	Distance to kerb (m)	Distance to relevant exposure [b]	2015	2016	2017	2018	2019	2020
Maid 51	Roadside	576147, 156488	3.5	0	33.4	**40.4**	36.7	35.7	34.6	25.3
Maid 63	Roadside	577037, 157739	12.8	0	32.4	34.9	34.4	30.1	29.0	20.4
Maid 74	Roadside	577377, 157131	6.0	0	32.9	33.3	34.8	29.6	28.4	22.0
Maid 80	Kerbside	576314, 156312	1.0	4.5	33.9	35.2	**35.0**	31.9	31.1	22.2
Maid 116	Roadside	573979, 158756	1.0	4.3	-	-	**58.5**	**53.3**	**49.2**	**42.7**
Maid 137	Roadside	575700, 156779	2.0	n/a	-	-	-	-	-	23.0
Maid 138	Roadside	577659, 157252	2.0	n/a	-	-	-	-	-	16.9

[a] Exceedances of the objective are shown in bold.

[b] A distance of 0 m denotes that the monitoring site is representative of relevant exposure (e.g. on the façade of a residential property).

Barming and West Maidstone

2.8 Monitoring is carried out at six locations within Barming and West Maidstone, as shown in **Figure 4** and **Table 3**. There have been no measured exceedances of the annual mean nitrogen dioxide objective since 2016 at any monitoring site in this area, and concentrations have all been well below the objective since 2018. There is also a clear downward trend in measured concentrations at these locations, as shown in Figure 5. It is therefore recommended that this section of the AQMA is revoked.

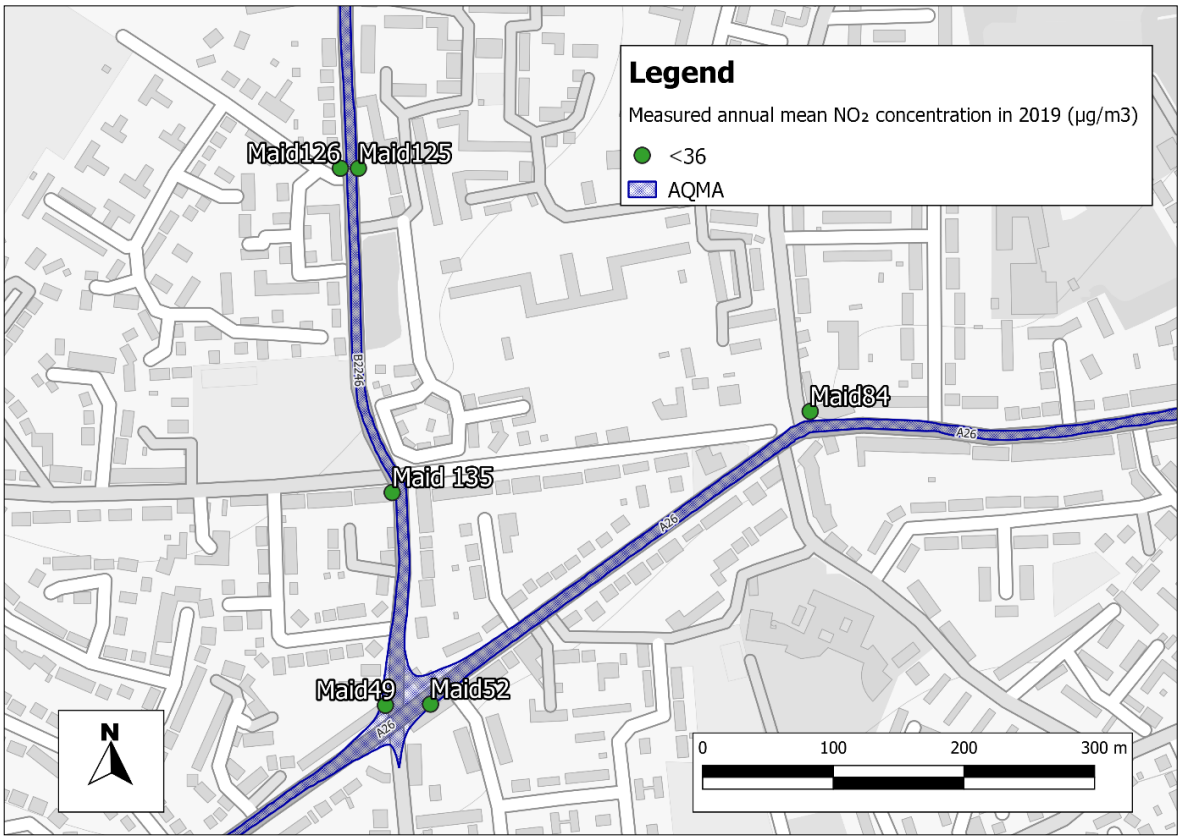

Figure 4: Air Quality Monitoring in Barming and West Maidstone

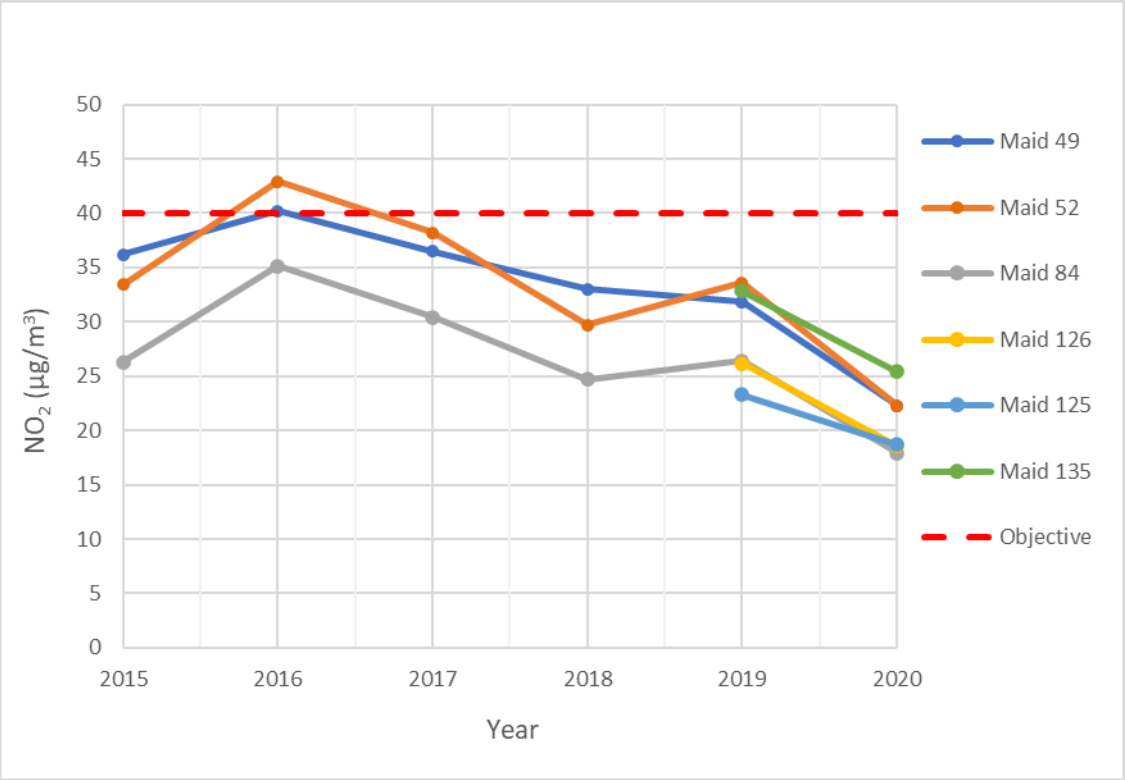

Figure 5: **Annual Mean NO_2 at Diffusion Tubes Monitoring Sites in Barming and West Maidstone**

Table 3: **Summary of Annual Mean Nitrogen Dioxide Monitoring (2016-2020) in Barming and West Maidstone (µg/m^3) [a]**

Site	Site Type	Location	Distance to kerb (m)	Distance to relevant exposure [b]	2015	2016	2017	2018	2019	2020
Maid 49	Roadside	573309, 154789	6.6	0.0	36.2	**40.2**	36.5	33.0	31.8	22.3
Maid 52	Roadside	573349, 154790	2.4	2.9	33.4	**42.9**	38.2	29.7	33.6	22.3
Maid 84	Roadside	573686, 155050	1.0	0.0	26.3	35.1	30.4	24.7	26.4	17.9
Maid 126	Roadside	573269, 155266	2.6	3.0	-	-	-	-	26.2	18.6
Maid 125	Roadside	573285, 155266	2.6	3.0	-	-	-	-	23.3	18.7
Maid 135	Roadside	573315, 154978	2.0	0.0	-	-	-	-	32.8	25.4

[a] Exceedances of the objective are shown in bold.

[b] A distance of 0 m denotes that the site is representative of relevant exposure (e.g. on the façade of a residential property).

Central Maidstone and the A229

2.9 Monitoring is carried out at one automatic monitoring station (CM3) and 19 diffusion tube monitors within central Maidstone and adjacent to the A229, as shown in **Figure 6**. Annual mean results for the years 2015 to 2020 are summarised in **Table 4**. The monitoring data for years earlier than 2020 have been taken from MBC's 2020 ASR (Maidstone Borough Council, 2020), while data for 2020 have been taken from the Council's 2021 ASR (Maidstone Borough Council, 2021).

2.10 At all locations except CM3, Maid81, Maid96, Maid122 and Maid53 measured concentrations have been below the annual mean objective (in the majority of cases well below the objective) for a number of years.

2.11 Monitors CM3, Maid81, Maid96, Maid122 and Maid53 are all located adjacent to the A229; CM3, Maid81, Maid96, Maid122 are all located adjacent to Upper Stone Street. Monitor Maid53 is located further to the south, outside the Wheatsheaf Pub at the junction of Loose Road and Sutton Road. Measured exceedances at these monitoring sites are significant, with concentrations, even in 2020, greater than 60 µg/m^3 at some locations, indicating the potential for exceedances of the 1-hour mean nitrogen dioxide objective. It is therefore recommended that detailed dispersion modelling of traffic emissions is carried out to determine the extent of exceedance at relevant locations within the area.

2.12 It is proposed that the model domain covers the A229 Upper Stone Street from the junction of Knightrider Street, up to the junction of Loose Road and Sutton Road. It should be noted that the Wheatsheaf Pub is likely to be demolished and is currently empty, and hence will not be used as a specific receptor in the modelling. Modelling will include specific receptor locations at heights of relevant exposure. The modelling will also incorporate the outcomes of traffic monitoring using Automatic Number Plate Recognition (ANPR) cameras, to provide an up-to-date indication of the vehicle fleet along Upper Stone Street (both in terms of vehicle type and Euro class of vehicle).

2.13 The monitoring data shown in **Figure 7** indicate that annual mean nitrogen dioxide concentrations are reducing, but trends are not as clear cut as in other locations across Maidstone. Therefore, in order to provide a worst-case approach for re-defining the AQMA, 2019 will be used as the baseline for the modelling. A discussion of the modelling approach and results are included in Section 3.

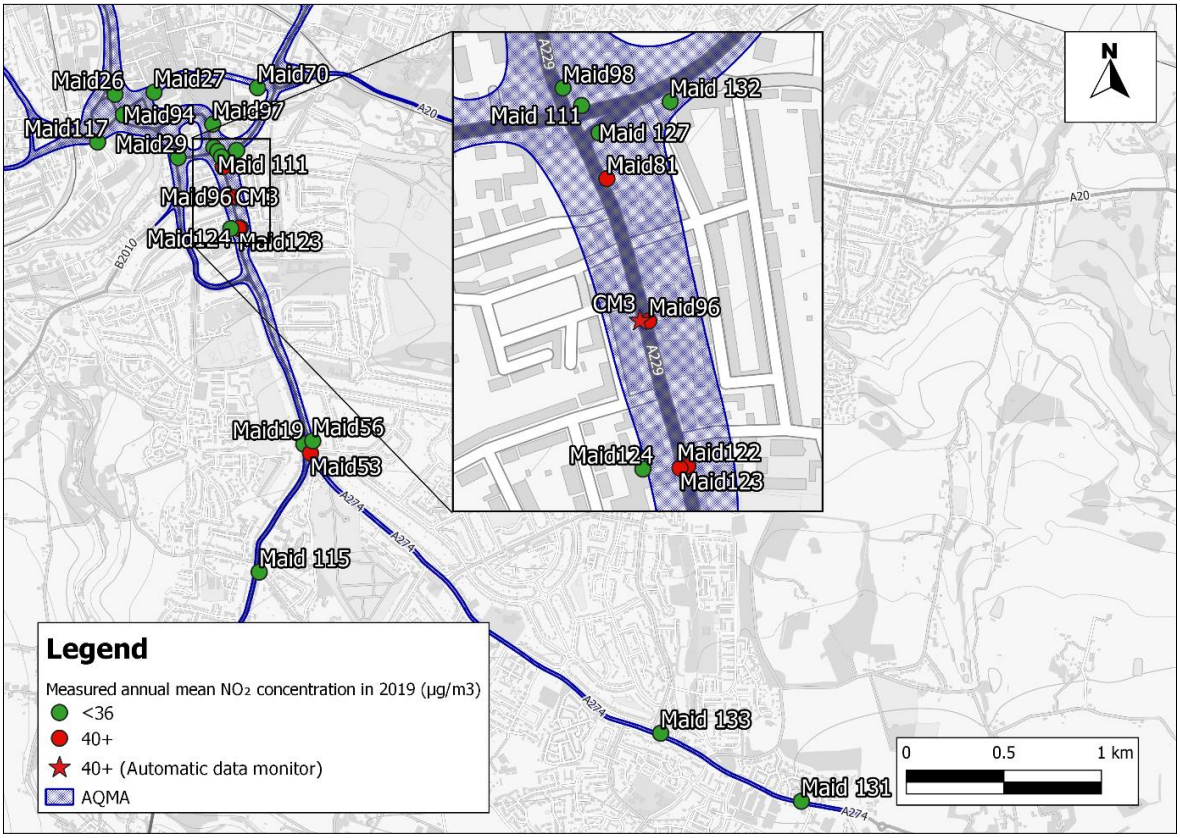

Figure 6: Air Quality Monitoring in Central Maidstone and the A229

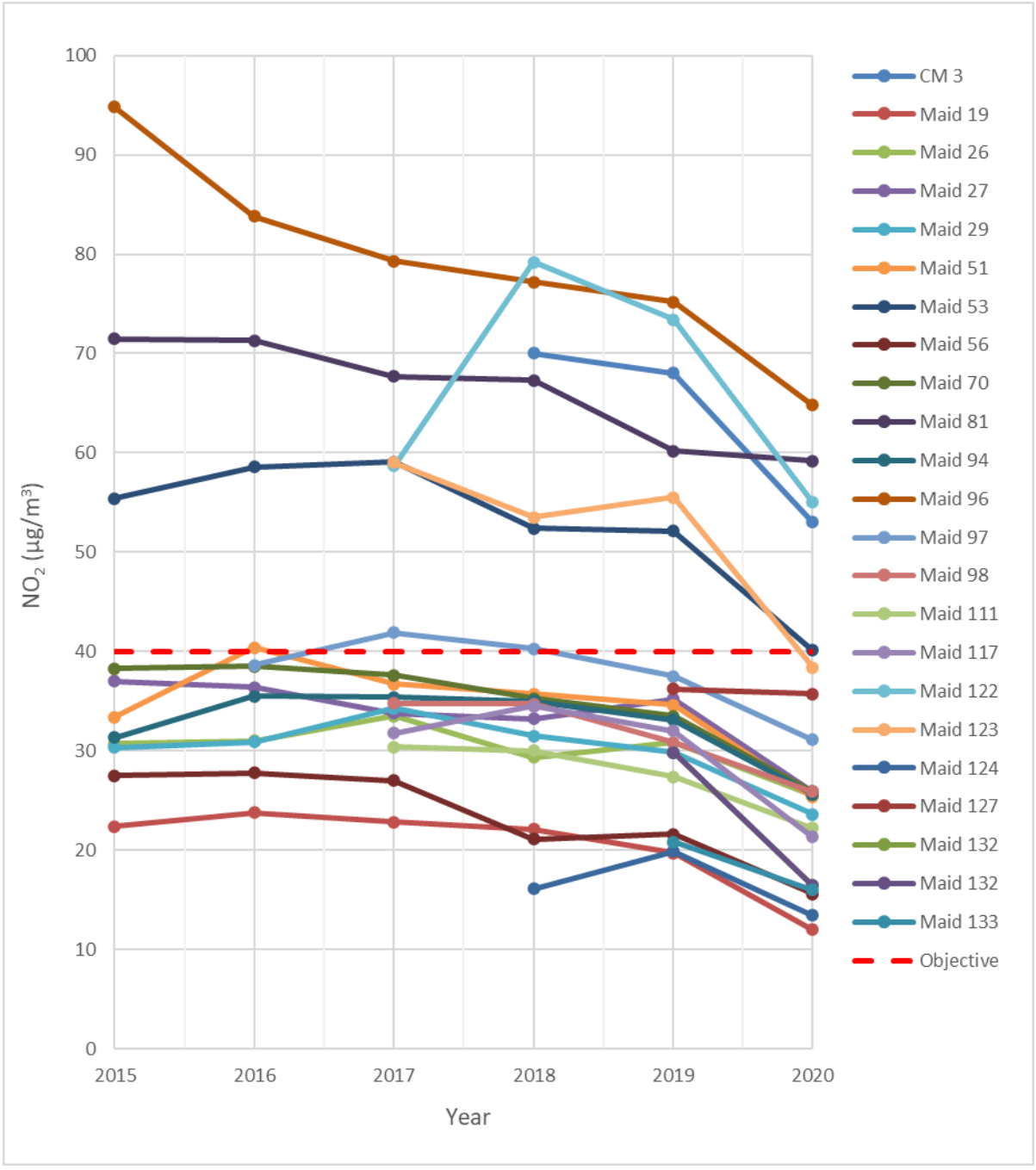

Figure 7: Annual Mean Nitrogen Dioxide Concentrations in Central Maidstone and the A229

Table 4: Summary of Nitrogen Dioxide Monitoring (2015-2020) in Central Maidstone and the A229 (µg/m^3)

Site	Site Type	Location	Distance to kerb (m)	Distance to relevant exposure [b]	2015	2016	2017	2018	2019	2020
CM3	Roadside	576337, 155183	1.5	n/a	**-**	**-**	-	**70**	**68**	**53**
Maid 19	Roadside	576692, 153992	13.3	0	22.4	23.8	22.8	22.1	19.7	12.0
Maid 26	Roadside	575782, 155678	3.0	0	30.7	31.0	33.5	29.3	30.8	25.5
Maid 27	Roadside	575970, 155688	4.4	1.2	37.0	36.4	33.8	33.2	35.2	25.9
Maid 29	Roadside	576086, 155373	2.8	41	30.3	30.9	34.3	31.5	29.9	23.6
Maid 51	Roadside	576147, 156488	0	3.5	33.4	**40.4**	36.7	35.7	34.6	25.3
Maid 53	Roadside	576724, 153948	1.0	2.0	**55.4**	**58.6**	**59.1**	**52.4**	**52.1**	**40.1**
Maid 56	Kerbside	576735, 154007	15.1	0	27.5	27.8	27.0	21.1	21.6	15.6
Maid 70	Roadside	576469, 155710	1.3	1.7	38.3	38.5	37.6	35.3	33.5	25.9
Maid 81	Kerbside	576303, 155329	0	1.0	**71.5**	**71.3**	**67.7**	**67.3**	**60.2**	**59.2**
Maid 94	Roadside	575822, 155183	10.0	0	31.3	35.5	35.4	35.0	33.1	25.6
Maid 96	Roadside	576346, 155183	1.5	0	**94.8**	**83.8**	**79.3**	**77.2**	**75.2**	**64.8**
Maid 97	Roadside	576253, 155534	2.1	5.0	-	38.6	**41.9**	**40.3**	37.5	31.1
Maid 98	Roadside	576258, 155422	3.0	5.0	-	35.2	34.8	34.7	30.8	25.9
Maid 111	Roadside	576277, 155404	1.5	9.8	-	-	30.4	30.0	27.4	22.2
Maid 117	Roadside	575698, 155448	1.3	31.0	-	-	31.8	34.5	32.0	21.3
Maid 122	Roadside	576386, 155032	1.5	0	-	-	**58.7**	**79.2**	**73.4**	**55.0**
Maid 123	Roadside	576378, 1550532	1.5	6.9	-	-	**59.0**	**53.5**	**55.5**	38.4
Maid 124	Roadside	576340, 155031	40.0	0	-	-	-	16.1	19.9	13.4
Maid 127	Roadside	576295, 155376	1.5	2.0	-	-	-	-	36.2	35.7
Maid 132	Roadside	576368, 155408	2.0	2.0	-	-	-	-	29.8	16.4
Maid 132	Roadside	576368, 155408	2.0	1.7	-	-	-	-	29.8	16.4
Maid 133	Roadside	578412, 152598	4.6	0	-	-	-	-	20.8	16.0

[a] Exceedances of the objective are shown in bold.

[b] A distance of 0 m denotes that the site is representative of relevant exposure (e.g. on the façade of a residential property).

3 Detailed Assessment of Upper Stone Street

Modelling Methodology

3.1 Annual mean concentrations of nitrogen dioxide have been predicted for the existing and future baselines (2019 Baseline and 2022 Baseline, respectively) and two future scenarios (2022 Euro VI Bus and 2022 EV Buses). The 2022 Euro VI Bus scenario assumes all buses and coaches meet Euro VI emission standards. The 2022 EV Bus scenario assumes all buses and coaches are converted to electric vehicles. Concentrations have been predicted throughout Upper Stone Street and Loose Road using the ADMS-Roads dispersion model, with vehicle emissions derived using Defra's Emission Factor Toolkit (EFT) (v11.0). Details of the model inputs, assumptions and the verification are provided in Appendix 0, together with the method used to derive background concentrations. Where assumptions have been made, a realistic worst-case approach has been adopted.

Receptors

3.2 Concentrations have been predicted at residential properties adjacent to Loose Road and Upper Stone Street, as derived from GIS data provided by MBC. Concentrations have been predicted at heights of relevant exposure. The specific receptors modelled are shown in Figure 8.

3.3 Concentrations have also been predicted across a 100 m x 100 m Cartesian grid centred on the junction of Sheal's Crescent and Loose Road (see **Figure 9**). Additional grids have also been considered at a spacing of 5 m x 5 m within 200 m of the modelled roads. The receptor grid has been modelled at a height of 1.5 m above ground level.

Traffic Data

3.4 ANPR data, provided by Intelligent Data, were collected on Upper Stone Street between 29 September and 5 October 2021. The dataset provides traffic counts and a breakdown of vehicles by type and Euro class. This information has been used together with modelled traffic flows for 2019 in the area (provided by Kent County Council (KCC)), to estimate traffic flows, fleet composition and speed across the area of focus in 2019 and 2022.

3.5 Defra's EFT has been used to estimate vehicle emissions using the Fleet Projection Tool to factor the 2021 ANPR fleet mix by Euro class back to the 2019 baseline year and forward to the 2022 future year.

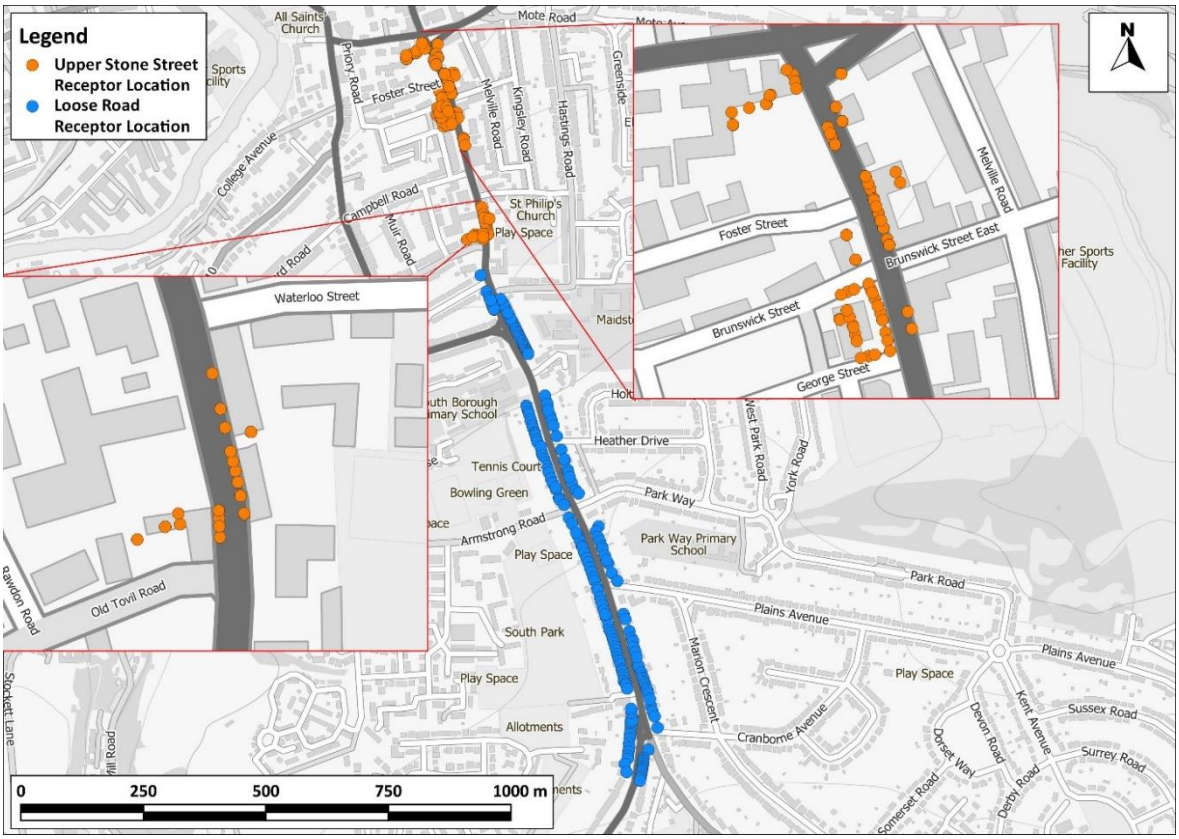

Figure 8: Specific Receptor Locations

Figure 9: Nested Cartesian Grids of Receptors

Uncertainty

3.6 There are many components that contribute to the uncertainty of modelling predictions.

3.7 The road traffic emissions dispersion model used in this assessment is dependent upon the traffic data that have been input, which will have inherent uncertainties associated with them, and any uncertainties inherent in these data will carry into the assessment. There will also be uncertainties associated with projecting the ANPR data from 2021 to 2019 and 2022 using Defra's EFT, and within the ANPR data themselves.

3.8 Uncertainty is also introduced when modelling the impacts of street canyons within the ADMS dispersion model and calculating the effect of gradients on vehicle emissions within the EFT. Both of these effects have been considered within the modelling.

3.9 There are then additional uncertainties as models are required to simplify real-world conditions into a series of algorithms. An important stage in the process is model verification, which involves comparing the model output with measured concentrations (see Appendix 0). Because the model

has been verified and adjusted, there can be reasonable confidence in the prediction of 2019 concentrations. LAQM.TG16 (Defra, 2021a) provides guidance on the evaluation of model performance. An analysis of the verification is shown in Table AError! No text of specified style in document..**3** in Appendix 0.

3.10 All of the measured concentrations presented will also have an intrinsic margin of error, which will also have been carried into the results of the modelling.

Modelling Results

2019 Baseline Scenario

3.11 **Figure 10** shows modelled annual mean nitrogen dioxide concentrations at the lowest modelled height at the specific receptors in the 2019 Baseline. This indicates that the annual mean objective is achieved at the majority of receptors, however there are exceedances of the objective predicted along Upper Stone Street. All of these locations are within street canyons formed by the buildings along Upper Stone Street, which is also on a gradient. It is estimated that the annual mean nitrogen dioxide objective is exceeded at 44 residential receptors in 2019 (including multiple floor levels at the same location), of which an annual mean concentration of 60 µg/m^3 is exceeded at approximately nine.

3.12 Two isopleth maps of the modelled annual mean nitrogen dioxide concentrations in the 2019 baseline, at ground-floor level of Upper Stone Street and Loose Road are presented in Figure 11 and **Figure 12**, respectively.

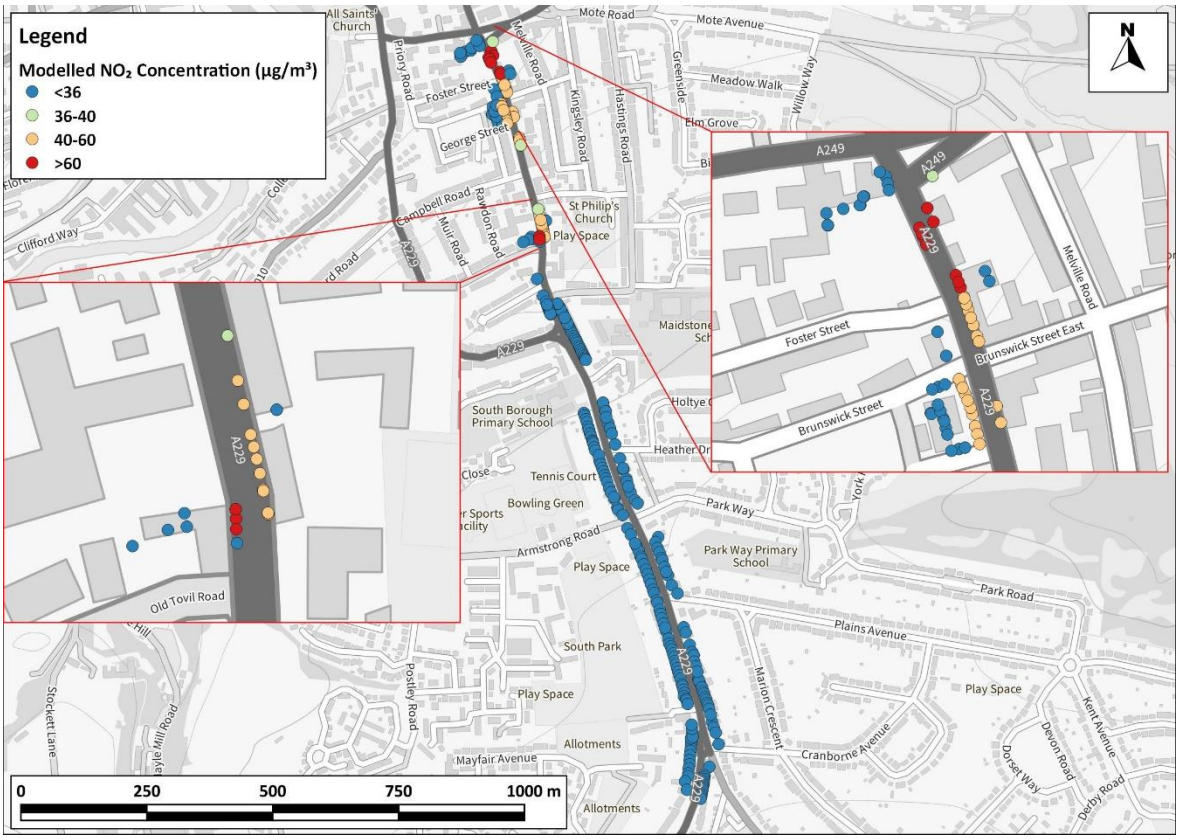

Figure 10: Modelled Annual Mean Nitrogen Dioxide Concentrations at Specific Receptors in 2019 Baseline

Figure 11: Contour Map of Modelled Annual Mean Nitrogen Dioxide Concentrations in 2019 Baseline along Upper Stone Street

Imagery ©2021 Google, Imagery ©2021 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies

Figure 12: Contour Map of Modelled Annual Mean Nitrogen Dioxide Concentrations in 2019 Baseline along Loose Road

Imagery ©2021 Google, Imagery ©2021 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies

3.13 Figure 11 indicates that the annual mean objective is predicted to be exceeded at locations adjacent to Lower Stone Street, Upper Stone Street and Mote Road, Loose Road, and at a small section along Sutton Road in 2019. However, it should be noted that the only locations of relevant exposure to the annual mean nitrogen dioxide objective at which the objective is predicted to be exceeded are

adjacent to Upper Stone Street. The contour bandings should be treated with caution, as the inclusion of street canyons within the modelling leads to large concentration gradients inside versus outside the canyon.

3.14 In general, the model is considered to over-predict concentrations at the junction of Upper Stone Street, Knightrider Street, Mote Road and Lower Stone Street and slightly under-predict at the section of Upper Stone Street between Brunswick Street and Old Tovil Road. At the junction of Lower Stone Street, Mote Road and Upper Stone Street, exceedances have been predicted by the model where measured concentrations were below the objective in 2019 (specifically monitoring sites Maid98, Maid111 and Maid127). The over-prediction at this location is, in part, a result of the use of a conservative verification factor, described in Appendix 0. Similarly, the verification factor used incorporates the locations at which the model performs well, leading to an under-predictions at the locations where measured concentrations are highest, i.e., Upper Stone Street.

3.15 The high predicted and measured concentrations along sections of Upper Stone Street are likely to be due to limited dispersion within these areas due to the presence of street canyons and the effects of the uphill gradient on that road. Measured concentrations adjacent to this section of road in 2019 are above the objective at locations of relevant exposure. Concentrations at the majority of the roadside receptors adjacent to Upper Stone Street are predicted to exceed the objective in 2019.

3.16 Predictions and measurements suggest concentrations at some locations adjacent to Upper Stone Street are also above 60 µg/m^3 and therefore there is a risk of exceedances of the 1-hour mean objective along this road; indeed, the objective was exceeded in 2019 at monitor CM3[8].

AQMA Recommendation

3.17 There is uncertainty surrounding both the measured and modelled concentrations. It is therefore recommended that any amendments to the AQMA include, as a minimum, all locations where measured and modelled concentrations exceed 36 µg/m^3 at specific locations of relevant exposure. This will reduce the possibility of having to extend the AQMA boundary as a result of annual variations in concentrations. The AQMA should, as a minimum, cover Upper Stone Street from the junction of the A429 to Old Tovil Road, as shown in **Figure 13**.

[8] See latest Annual Status Report for details.

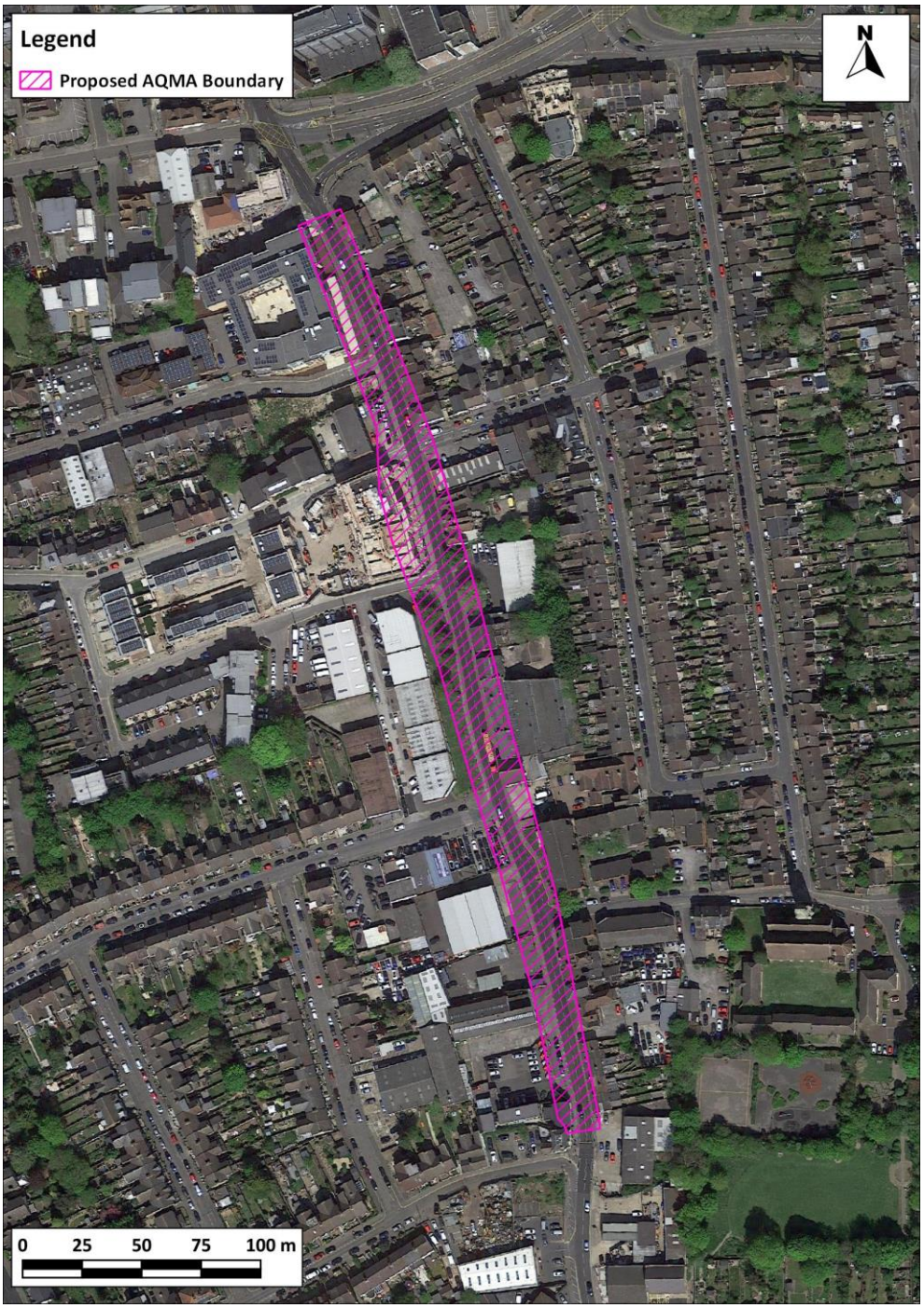

Figure 13: Proposed AQMA Boundary

Imagery ©2022 Google, Imagery ©2022 Getmapping plc, Infoterra Ltd & Bluesky, Maxar Technologies

2022 Baseline Scenario

3.18 **Figure 14** shows modelled annual mean nitrogen dioxide concentrations at the lowest modelled height at the specific receptors in the 2022 Baseline. This indicates that the annual mean objective is exceeded at fewer receptors in 2022 than in 2019 adjacent to Upper Stone Street, without any

intervention. In particular, several receptors to the north and south of Brunswick Street East and two receptors to the south of Waterloo Street are no longer predicted to exceed the objective. There are also fewer predicted exceedances of 60 µg/m^3 between Brunswick Street East and the A429, and north of Old Tovil Road. In total, it is estimated that the annual mean nitrogen dioxide objective is exceeded at 27 receptors in the 2022 Baseline, of which an annual mean concentration of 60 µg/m^3 is exceeded at approximately three.

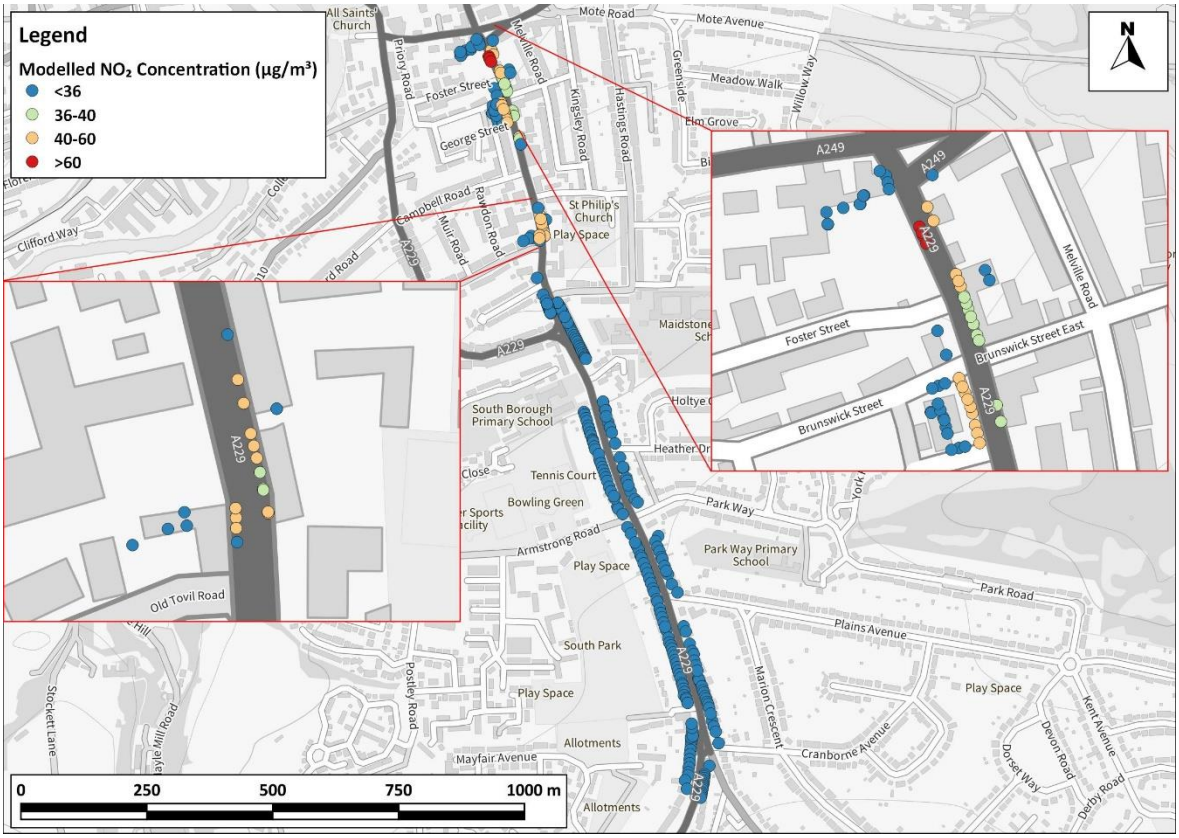

Figure 14: Modelled Annual Mean Nitrogen Dioxide Concentrations at Specific Receptors in 2022 Baseline

2022 Euro VI Bus Scenario

3.19 **Figure 15** shows modelled annual mean nitrogen dioxide concentrations at the specific receptors in the 2022 Euro VI Bus scenario. Compared to the 2022 Baseline scenario, the objective is predicted to be achieved at additional receptors to the south of Brunswick Street and to the south of Waterloo Street. Exceedances of the objective are predicted to remain to the north of Old Tovil Road, to the north of George Street, opposite and north of Foster Street. Concentrations exceeding 60 µg/m^3 are predicted north of Foster Street. In total, is it estimated that the annual mean nitrogen dioxide

objective is exceeded at 15 receptors in the 2022 Euro VI Bus Scenario, of which an annual mean concentration of 60 µg/m^3 is exceeded at approximately three.

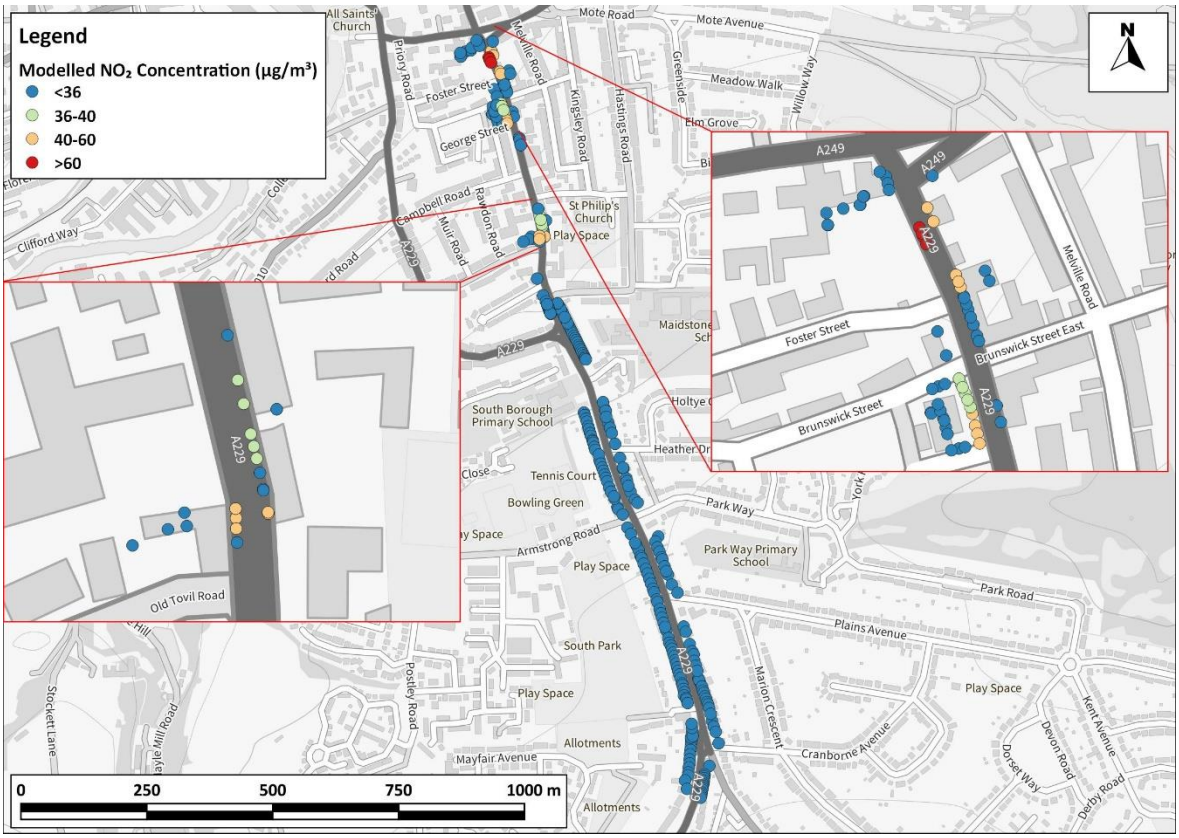

Figure 15: Modelled Annual Mean Nitrogen Dioxide Concentrations at Specific Receptors in 2022 Euro VI Bus Scenario

2022 EV Bus Scenario

3.20 **Figure 16** shows modelled annual mean nitrogen dioxide concentrations at the specific receptors in the 2022 EV Bus scenario. There is no difference between the 2022 Euro VI Bus and 2022 EV Bus scenarios, in terms of how many exceedances of the objective and of 60 µg/m^3 are predicted to occur.

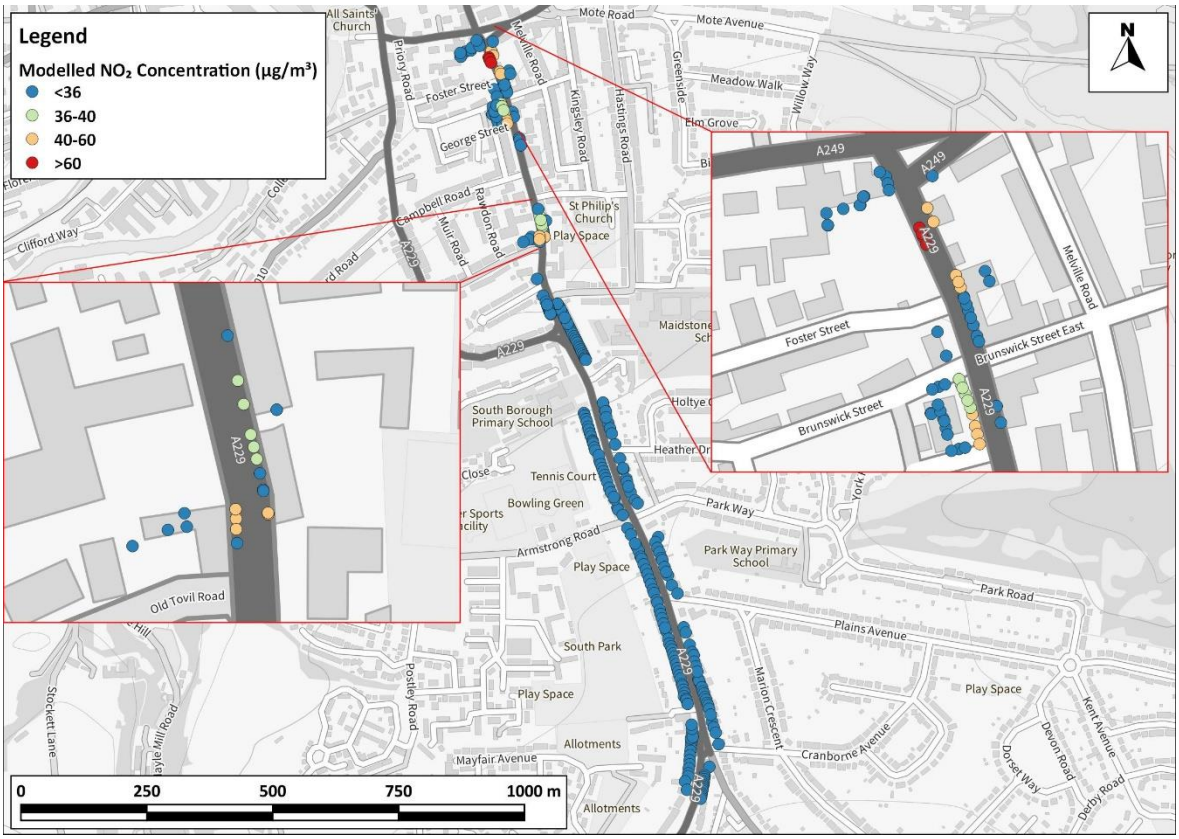

Figure 16: Modelled Annual Mean Nitrogen Dioxide Concentrations at Specific Receptors in 2022 EV Bus Scenario

Source Apportionment on Upper Stone Street

3.21 Defra's EFT has been used to provide an indication of the proportion of road traffic emissions on Upper Stone Street from each vehicle and Euro class type in 2019. Emissions of particulate matter from each vehicle type have been included for information.

3.22 Figure 17 and Table 5 show the percentage of emissions by vehicle type. This has been calculated using the total modelled annual emissions on Upper Stone Street in 2019 and the Source Apportionment option within the EFT. The results indicate that the majority of road NOx emissions in 2019 were produced by Diesel Cars (33.0%), followed by Buses/Coaches (20.4%), Rigid Heavy Goods Vehicles (HGVs) (17.5%), and Diesel Light Goods Vehicles (LGVs) (17.4%). For particulate matter emissions (PM_{10} and $PM_{2.5}$), the contribution from Petrol Cars is proportionally much higher than for NOx.

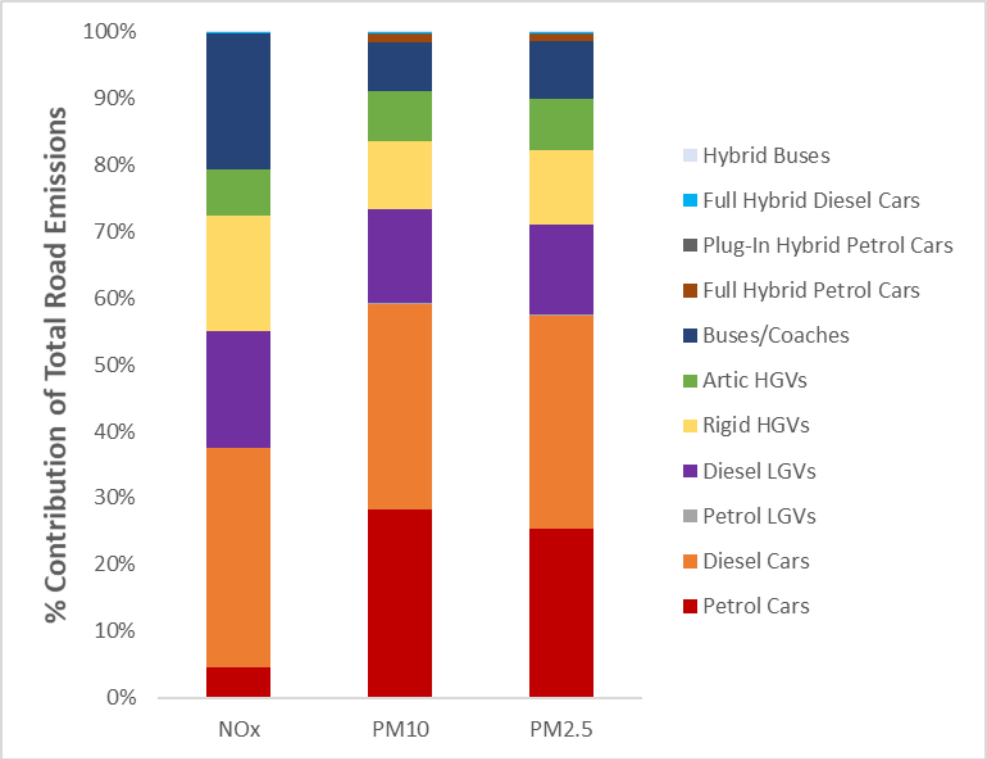

Figure 17: Percentage Contribution of Total Road Emissions by Vehicle Type (2019 Baseline)

Table 5: Percentage Contribution of Total Road Emissions by Vehicle Type (2019)

Vehicle Type	NOx (%)	PM_{10} (%)	$PM_{2.5}$ (%)
Petrol Cars	4.5	28.3	25.3
Diesel Cars	33.0	30.7	32.1
Petrol LGVs	0.0	0.2	0.2
Diesel LGVs	17.4	14.0	13.6
Rigid HGVs	17.5	10.2	11.2
Artic HGVs	6.9	7.5	7.6
Buses/Coaches	20.4	7.4	8.7
Full Hybrid Petrol Cars	0.1	1.1	1.0
Plug-In Hybrid Petrol Cars	0.0	0.3	0.3
Full Hybrid Diesel Cars	0.2	0.2	0.2
FCEV LGVs	0.0	0.0	0.0
CNG Buses	0.0	0.0	0.0
Hybrid Buses	0.1	0.1	0.1
FCEV Buses	0.0	0.0	0.0

3.23 Figure 18, Figure 19, Table 6 and Table 7 show the percentage contribution of NOx emissions by vehicle Euro class for Light Duty Vehicles (LDVs) and Heavy Duty Vehicles (HDVs; HGVs and

Buses/Coaches), respectively. The proportions have been calculated based on the annual emissions from all modelled roads using the EFT's Euro Emissions Standards Summary for NOx.

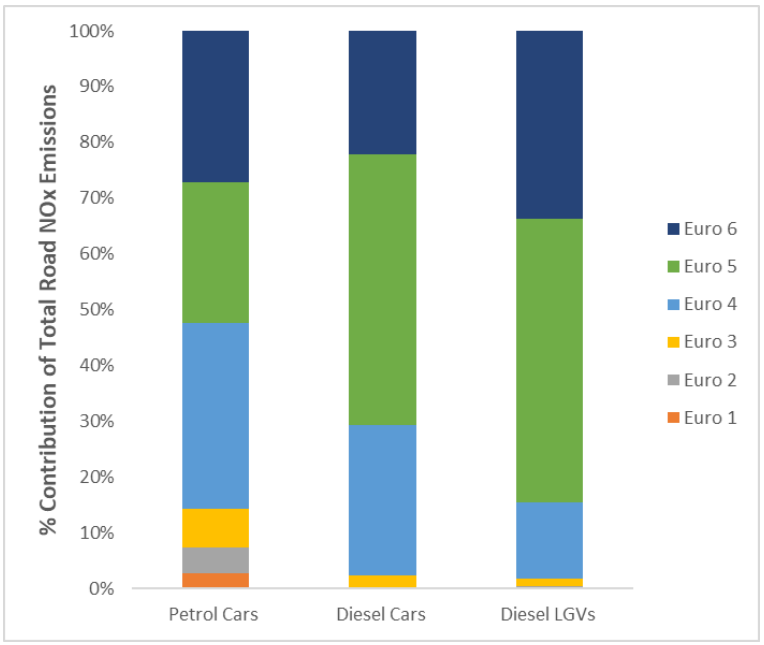

Figure 18: Percentage Contribution of Total Road NOx Emissions from Light Duty Vehicles by Euro Class Type (2019 Baseline)

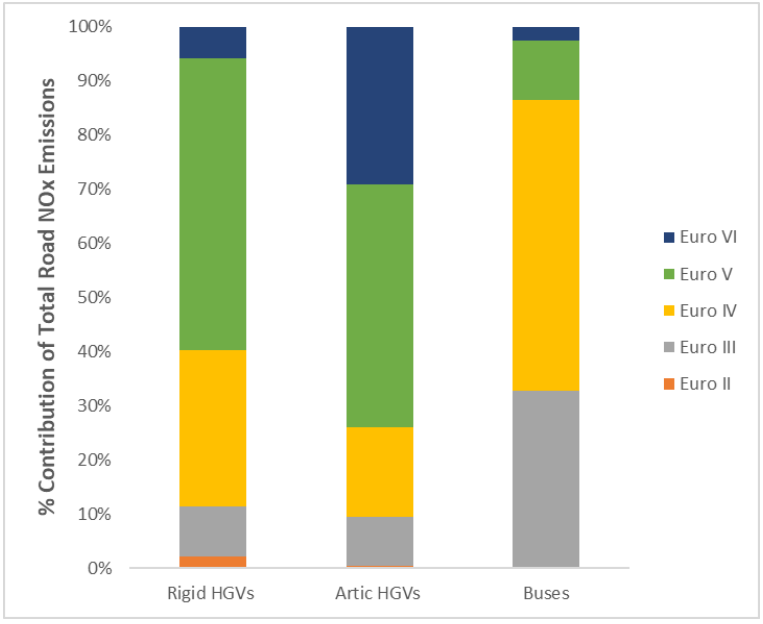

Figure 19: Percentage Contribution of Total Road NOx Emissions from Heavy Duty Vehicles by Euro Class Type (2019 Baseline)

Table 6: Percentage Contribution of Total Road Emissions from Light Duty Vehicles by Euro Class Type (2019)

Euro Standard	Petrol Cars (%)	Diesel Cars (%)	Diesel LGVs (%)
Euro 1	2.7	0.1	0.0
Euro 2	4.7	0.1	0.5
Euro 3	6.9	2.1	1.2
Euro 4	33.3	27.0	13.8
Euro 5	25.3	48.5	50.8
Euro 6	27.1	22.2	33.7

Table 7: Percentage Contribution of Total Road Emissions from Heavy Duty Vehicles by Euro Class Type (2019)

Vehicle Type	Rigid HGVs	Artic HGVs	Buses
Euro II	2.1	0.5	0.3
Euro III	9.3	9.0	32.5
Euro IV	28.8	16.7	53.7
Euro V	53.9	44.9	11.0
Euro V	5.8	29.0	2.5
Euro VI	2.1	0.5	0.3

3.24 Figure 18 and Table 6 indicate that the majority of NOx emissions from Petrol Cars in 2019 are from Euro 4 vehicles (33.3%), while for Diesel Cars and LGVs, Euro 5 vehicles emit the highest proportion of NOx (48.5% and 50.8%, respectively). In terms of HDVs, Figure 19 and Table 7 indicate that the majority of NOx emissions from Rigid and Artic HGVs in 2019 are from Euro V vehicles (53.9% and 44.9%, respectively), while for Buses/Coaches, the majority of emissions are from Euro IV vehicles (53.7%).

3.25 The ANPR data (after manual assignment of Euro classes as described in Paragraph 0) show that approximately 18% of the bus fleet within Maidstone centre in 2021 are Euro III vehicles and 43% are Euro IV vehicles. This is taken to indicate an older than average bus fleet, although this assumption should be treated with some caution (see Paragraph 0).

3.26 It should be noted that these proportions are calculated based on a series of assumptions (as described in Paragraph 0), and are estimated for 2019 using Defra's EFT, based on ANPR data collected in 2021, corrected to 2019 where possible.

4 Summary

4.1 Detailed modelling on Upper Stone Street has shown that the predicted annual mean nitrogen dioxide concentrations in 2019 exceed the objective on the one-way section of that road, but not at locations of relevant exposure elsewhere. The majority of road NOx emissions on Upper Stone Street in 2019 can be attributed to diesel vehicles; primarily cars, followed by buses and coaches, rigid HGVs and LGVs.

4.2 Based on an analysis of the monitoring data within Maidstone between 2015 and 2019, and a modelling study covering central Maidstone and the A229, it is recommended that the extent of the AQMA is reduced to cover Upper Stone Street only. It is considered that the AQMA can be revoked in northern Maidstone and the M20 in that area, Barming and west Maidstone, and Loose Road, Sutton Road and Sheal's Crescent in central Maidstone.

4.3 Future (2022) modelling scenarios show that predicted annual mean nitrogen dioxide concentrations continue to fall within the study area without any intervention to reduce road NOx emissions, however, exceedances of the annual mean nitrogen dioxide objective are predicted to persist adjacent to Upper Stone Street. Assuming that all buses and coaches either meet Euro VI emission standard, or that all buses and coaches are converted to electric vehicles, further reduces the predicted concentrations and the number of exceedances, but not to the extent that all receptors are predicted to meet the objective.

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6 Glossary

AADT	Annual Average Daily Traffic
ADMS-Roads	Atmospheric Dispersion Modelling System model for Roads
ANPR	Automatic Number Plate Recognition
ASR	Annual Status Report
AQC	Air Quality Consultants
AQMA	Air Quality Management Area
Defra	Department for Environment, Food and Rural Affairs
DfT	Department for Transport
EFT	Emission Factor Toolkit
Exceedance	A period of time when the concentration of a pollutant is greater than the appropriate air quality objective. This applies to specified locations with relevant exposure
HDV	Heavy Duty Vehicles (> 3.5 tonnes)
HMSO	Her Majesty's Stationery Office
HGV	Heavy Goods Vehicle
IAQM	Institute of Air Quality Management
kph	Kilometres Per hour
LAQM	Local Air Quality Management
LDV	Light Duty Vehicles (<3.5 tonnes)
LGV	Light Goods Vehicle
MBC	Maidstone Borough Council
µg/m^3	Microgrammes per cubic metre
NO	Nitric oxide
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides (taken to be NO_2 + NO)
Objectives	A nationally defined set of health-based concentrations for nine pollutants, seven of which are incorporated in Regulations, setting out the extent to which the standards should be achieved by a defined date. There are also vegetation-based objectives for sulphur dioxide and nitrogen oxides

OGV	Other Goods Vehicle
Standards	A nationally defined set of concentrations for nine pollutants below which health effects do not occur or are minimal
TEMPro	Trip End Model Presentation Program

7 Appendices

Professional Experience

Dr Clare Beattie, BSc (Hons) MSc PhD CSci MIEnvSc MIAQM

Dr Beattie is an Associate Director with AQC, with more than 20 years' relevant experience. She has been involved in air quality management and assessment, and policy formulation in both an academic and consultancy environment. She has prepared air quality review and assessment reports, strategies and action plans for local authorities and has developed guidance documents on air quality management on behalf of central government, local government and NGOs. She has led on the air quality inputs into Clean Air Zone feasibility studies and has provided support to local authorities on the integration of air quality considerations into Local Transport Plans and planning policy processes. Dr Beattie has appraised local authority air quality assessments on behalf of the UK governments, and provided support to the Review and Assessment helpdesk. She has carried out numerous assessments for new residential and commercial developments, including the negotiation of mitigation measures where relevant. She has also acted as an expert witness for both residential and commercial developments. She has carried out BREEAM assessments covering air quality for new developments. Dr Beattie has also managed contracts on behalf of Defra in relation to allocating funding for the implementation of air quality improvement measures. She is a Member of the Institute of Air Quality Management, Institution of Environmental Sciences and is a Chartered Scientist.

Dr Kate Wilkins, BSc (Hons) MSc PhD MIEnvSc MIAQM

Dr Wilkins is a Senior Consultant with AQC with eight years' postgraduate and work experience in the field of Environmental and Earth Sciences. Since joining AQC in January 2018, she has undertaken numerous air quality impact assessments for road traffic, combustion plant and construction dust throughout the UK for both standalone assessments and for EIAs, and has also prepared local authority reports and literature reviews. She has contributed her technical skills in programming and specialist software to a range of large-scale projects, including the third runway at Heathrow airport. Previously, Kate completed a PhD at the University of Bristol, researching atmospheric dispersion modelling and satellite remote sensing of volcanic ash. Prior to her PhD she spent a year working at the Environment Agency in Flood Risk Management. She is a Member of both the Institute of Air Quality Management and the Institution of Environmental Sciences.

George Chousos, BSc MSc AMIEnvSc AMIAQM

Mr Chousos is an Assistant Consultant with AQC, having joined in May 2019. Prior to joining AQC, he completed an MSc in Air Pollution Management and Control at the University of Birmingham, specialising in air pollution control technologies and management, and data processing using R. He also holds a degree in Environmental Geoscience from the University of Cardiff, where he undertook

a year in industry working in the field of photo-catalytic technology. He is now gaining experience in the field of air quality monitoring and assessment.

Helen Pearce, BSc (Hons) MSc

Miss Pearce is an Assistant Consultant with AQC, having joined in September 2021. Prior to joining AQC she was based at the University of Birmingham, completing a BSc in Geography, MSc in Applied Meteorology and Climatology, and is currently awaiting her PhD examination. Her PhD research specialised in air quality modelling where she developed a range of tools to estimate real-time pollutant concentrations on Birmingham's road network, and to quantify the impacts of Low Traffic Neighbourhoods on residential population exposure. Additionally, she provided the air quality modelling expertise on the NERC-funded project, 'GI4RAQ' (Green Infrastructure for Roadside Air Quality), to quantitively assess the impacts of 'green' interventions in street environments. She is now gaining experience in the field of air quality monitoring and assessment.

Joe Rondel

Mr Rondel is an Environmental Monitoring Technician with AQC, having joined the Company in 2021. Prior to joining AQC he gained a degree in Geography from the University of Manchester, specialising in biological science and economics. He is now gaining experience in the field of air quality monitoring, including passive and active sampling techniques.

Modelling Methodology

Assumptions

It is necessary to make a number of assumptions when carrying out an air quality assessment; in order to account for some of the uncertainty in the approach, as described in Section 3, assumptions made have generally sought to reflect a realistic worst-case scenario. Not least, 2019 was used as the modelled year to provide a worst-case approach. Key assumptions made in carrying out this assessment include:

- a high proportion of the bus/coach vehicle category within the ANPR dataset does not have a Euro class assigned. Intelligent Data, who collected the data, have advised that the Euro status data is derived from the Motor Vehicle Registration Information System (MVRIS; a database of new vehicle registration details in the UK for cars and commercial vehicles <6 t gross vehicle weight). For commercial vehicles and buses/coaches of 6 t gross vehicle weight and over, this data service launched in 2016, thus for heavy vehicles registered before 2016, there are a high proportion of missing Euro class records in DVLA database. This will have skewed the Euro mix for these vehicles towards later classes. To mitigate this effect, classes for bus/coach, OGV1 and OGV2 vehicles have been assigned based on the vehicle registration date (where available) where no Euro class is already defined. Where no registration date is available, where possible, classes have been assigned based on the vehicle model and make;
- the vehicle categories for HGVs used within the ANPR dataset do not match the definitions within the EFT; EFT uses Rigid and Articulated HGV categories, while the ANPR separates HGVs by Other Goods Vehicles groups (OGV1; rigid vehicles >3.5 tonnes with two or three axles, and OGV2; rigid vehicles with four or more axles and articulated vehicles). Based on the proportions of these vehicles within the default EFT fleet mix, it is considered appropriate to assume that all OGV1 vehicles represent Rigid HGVs and OGV2 vehicles represent Articulated HGVs within the modelling;
- within the EFT, it has been assumed that that all electric and electric/hybrid petrol cars are petrol cars and all electric/hybrid diesel cars are diesel cars;
- it has been assumed that the EFT fleet projections for 2019 and 2022 are representative of those years, based on ANPR data collected in 2021;
- all buses and coaches have been removed from the fleet in the 2022 EV Bus scenario to simulate all buses having been converted to EVs;
- Mote Road, Upper Stone Street and Loose Road are on gradients;
- it has been assumed that the East Malling meteorological monitoring station appropriately represents conditions in the study area (this is discussed further in Paragraph 0); and

- sections of Upper Stone Street are located within street canyons (this is discussed further Paragraph 0).

Background Concentrations

Background concentrations have been defined using Defra's 2018-based background maps (Defra, 2021b), calibrated against local measurements made at the Maid45 background diffusion tube monitoring site. The measured nitrogen dioxide concentrations at this site in 2019 was 1.10 times higher than the 2019 Defra mapped background concentrations. All mapped nitrogen dioxide background concentrations for the grid squares covering the study area have therefore been adjusted by applying a factor of 1.10.

Model Inputs

Predictions have been carried out using the ADMS-Roads dispersion model (v5). The model requires the user to provide various input data, including emissions from each section of road and the road characteristics (including road width, street canyon height and porosity, where relevant). Vehicle emissions have been calculated based on vehicle flow, composition and speed data using the EFT (Version 11.0) published by Defra.

Vehicle fleet composition data have been based on ANPR data, provided by Intelligent Data, which were collected on Upper Stone Street between 29 September and 5 October 2021. The dataset provides traffic counts and a breakdown of vehicles by type and Euro class. This information has been used together with modelled traffic flows for 2019 in the area (provided by KCC), to estimate traffic flows, fleet composition and speed across the area of focus in 2019. Defra's EFT has been used to estimate vehicle emissions using the Fleet Projection Tool to factor the 2021 ANPR fleet mix by Euro class back to the 2019 baseline year. Traffic counts for Sheal's Crescent have been based on counts provided by DfT (2021). The 2019 AADT flows have been factored forwards to the future assessment year of 2022 using growth factors derived using the TEMPro System v7.2 (DfT, 2017). Speeds have been based on those provided by KCC, with some having been adjusted based on professional judgement, taking account of the road layout, speed limits and the proximity to junctions.

The traffic data used in this assessment are summarised in Table AError! No text of specified style in document.**.1**. The diurnal flow profile for the traffic has been derived using the ANPR data, and the monthly flow profile has been derived from the national profiles published by DfT (2020).

Table A Error! No text of specified style in document.**.1: Summary of Traffic Data used in the Assessment**

Road Link	AADT	% Petrol Car	% Diesel Car	% LGV	% Rigid HGV	% Artic HGV	% Bus/ Coach	% Motor Cycle
2019 Baseline								
Lower Stone Street	11,983 – 18,803	44.0 - 44.5	36.1 - 36.5	13.4 - 13.6	2.3 - 2.8	1.7 - 2.1	1.4 - 1.7	0.0
Knightrider Street	4,923 – 5,646	44.8	36.6 - 36.7	13.6	2.1	1.5 - 1.6	1.3	0.0
Mote Road (A249)	1,098 – 6,115	44.8 - 47	36.7 - 38.5	13.6 - 14.3	0.1 - 2.1	0.0 - 1.5	0.0 - 1.3	0.0
Wat Tyler Way (A249)	2,545 – 5,247	44.6 - 45.6	36.5 - 37.3	13.6 - 13.9	1.4 - 2.3	1.0 - 1.7	0.8 - 1.4	0.0
Upper Stone Street (A229) – west of Mote Road	11,007	43.6	35.7	13.3	3.2	2.4	1.9	0.0
Upper Stone Street (A229) – south of Mote Road	13,329 – 17,300	44.0 - 44.4	36.0 - 36.4	13.4 - 13.5	2.4 - 2.8	1.8 - 2.1	1.5 - 1.7	0.0
Loose Road (A229) – north of Sheal's Crescent	13,329 – 15,544	44.3 - 44.7	36.3 - 36.6	13.5 - 13.6	2.2 - 2.5	1.6 - 1.8	1.3 - 1.5	0.0
Sheal's Crescent	12,434	44.1	36.1	12.9	2.5	1.9	1.5	1.0
Loose Road (A229) – north of Park Way	10,494 – 18,165	43.3 - 43.7	35.5 - 35.8	13.2 - 13.3	3.1 - 3.4	2.3 - 2.5	1.9 - 2.1	0.0
Loose Road (A229) – north of Sutton Road (A274)	22,360 – 24,443	44.1 - 44.3	36.1 - 36.3	13.4 - 13.5	2.5 - 2.7	1.9 - 2.0	1.5 - 1.6	0.0
Loose Road (A229) – west of Sutton Road (A274)	13,752	44.4	36.4	13.5	2.4	1.8	1.5	0.0
Sutton Road (A274)	13,920	44.8	36.7	13.7	2.0	1.5	1.2	0.0
2022 Baseline & 2022 Euro VI Bus								
Lower Stone Street	12,534 – 19,668	44.0 - 44.5	36.1 - 36.5	13.4 - 13.6	2.3 - 2.8	1.7 - 2.1	1.4 - 1.7	0.0
Knightrider Street	5,150 – 5,906	44.8	36.6 - 36.7	13.6	2.1	1.5 - 1.6	1.3	0.0
Mote Road (A249)	1,149 – 6,397	44.8 - 47	36.7 - 38.5	13.6 - 14.3	0.1 - 2.1	0.0 - 1.5	0.0 - 1.3	0.0
Wat Tyler Way (A249)	2,662 – 5,488	44.6 - 45.6	36.5 - 37.3	13.6 - 13.9	1.4 - 2.3	1.0 - 1.7	0.8 - 1.4	0.0
Upper Stone Street (A229) – west of Mote Road	11,514	43.6	35.7	13.3	3.2	2.4	1.9	0.0
Upper Stone Street (A229) – south of Mote Road	13,942 – 18,095	44.0 - 44.4	36.0 - 36.4	13.4 - 13.5	2.4 - 2.8	1.8 - 2.1	1.5 - 1.7	0.0
Loose Road (A229) – north of Sheal's Crescent	13,942 – 16,259	44.3 - 44.7	36.3 - 36.6	13.5 - 13.6	2.2 - 2.5	1.6 - 1.8	1.3 - 1.5	0.0
Sheal's Crescent	13,005	44.1	36.1	12.9	2.5	1.9	1.5	1.0
Loose Road (A229) – north of Park Way	10,977 – 19,001	43.3 - 43.7	35.5 - 35.8	13.2 - 13.3	3.1 - 3.4	2.3 - 2.5	1.9 - 2.1	0.0

Loose Road (A229) – north of Sutton Road (A274)	23,388 – 25,568	44.1 - 44.3	36.1 - 36.3	13.4 - 13.5	2.5 - 2.7	1.9 - 2.0	1.5 - 1.6	0.0
Loose Road (A229) – west of Sutton Road (A274)	14,385	44.4	36.4	13.5	2.4	1.8	1.5	0.0
Sutton Road (A274)	14,560	44.8	36.7	13.7	2.0	1.5	1.2	0.0
2022 EV Bus								
Lower Stone Street	12,534 – 19,668	44.8 - 45.2	36.7 - 37	13.6 - 13.8	2.3 - 2.8	1.7 - 2.1	0.0	0.0
Knightrider Street	5,150 – 5,906	45.3 - 45.4	37.1	13.8	2.1	1.6	0.0	0.0
Mote Road (A249)	1,149 – 6,397	45.4 - 47.0	37.1 - 38.5	13.8 - 14.3	0.1 - 2.1	0.0 - 1.6	0.0	0.0
Wat Tyler Way (A249)	2,662 – 5,488	45.2 - 45.9	37 - 37.6	13.8 - 14.0	1.4 - 2.3	1.0 - 1.7	0.0	0.0
Upper Stone Street (A229) – west of Mote Road	11,514	44.4	36.4	13.5	3.2	2.4	0.0	0.0
Upper Stone Street (A229) – south of Mote Road	13,942 – 18,095	44.8 - 45.1	36.7 - 36.9	13.6 - 13.7	2.4 - 2.8	1.8 - 2.1	0.0	0.0
Loose Road (A229) – north of Sheal's Crescent	13,942 – 16,259	45.0 - 45.3	36.9 - 37.1	13.7 - 13.8	2.2 - 2.5	1.7 - 1.9	0.0	0.0
Sheal's Crescent	13,005	44.8	36.6	13.1	2.6	1.9	0.0	1.0
Loose Road (A229) – north of Park Way	10,977 – 19,001	44.2 - 44.5	36.2 - 36.4	13.5 - 13.6	3.1 - 3.5	2.3 - 2.6	0.0	0.0
Loose Road (A229) – north of Sutton Road (A274)	23,388 – 25,568	44.8 - 45	36.7 - 36.9	13.7	2.5 - 2.7	1.9 - 2.0	0.0	0.0
Loose Road (A229) – west of Sutton Road (A274)	14,385	45.1	36.9	13.7	2.4	1.8	0.0	0.0
Sutton Road (A274)	14,560	45.4	37.2	13.8	2.1	1.5	0.0	0.0

Figure AError! No text of specified style in document.**.1** shows the road network included within the model, along with the speed at which each link was modelled.

Figure A Error! No text of specified style in document.**..1: Modelled Road Network & Speed**

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For the purposes of modelling, it has been assumed that sections of Upper Stone Street are within street canyons formed by buildings. This road has a number of canyon-like features, which reduce dispersion of traffic emissions, and can lead to concentrations of pollutants being higher here than they would be in areas with greater dispersion. Sections of Upper Stone Street have, therefore, been modelled as street canyons using ADMS-Roads' advanced canyon module, with appropriate input parameters determined from local mapping. The advanced canyon module has been used, the input data for which have been published by Cambridge Environmental Research Consultants (CERC, 2016), who developed the ADMS models. The modelled canyons are shown in Figure AError! No text of specified style in document.**.2**.

Figure A Error! No text of specified style in document.**.2: Modelled Canyons**

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Hourly sequential meteorological data in sectors of 10 degrees from East Malling for 2019 have been used in the model. The East Malling meteorological monitoring station is located 5.5 km to the northwest of Maidstone. It is deemed to be the nearest monitoring station representative of meteorological conditions in the vicinity of Maidstone; both are located at inland locations in the south-east of England, where they will be influenced by the effects of inland meteorology. A wind rose for the site for the year 2019 is provided in Figure AError! No text of specified style in document.**.3**. The station is operated by the UK Met Office. Raw data were provided by the Met Office and processed by AQC for use in ADMS. Meteorological model input parameters are summarised in Table AError! No text of specified style in document.**.2**.

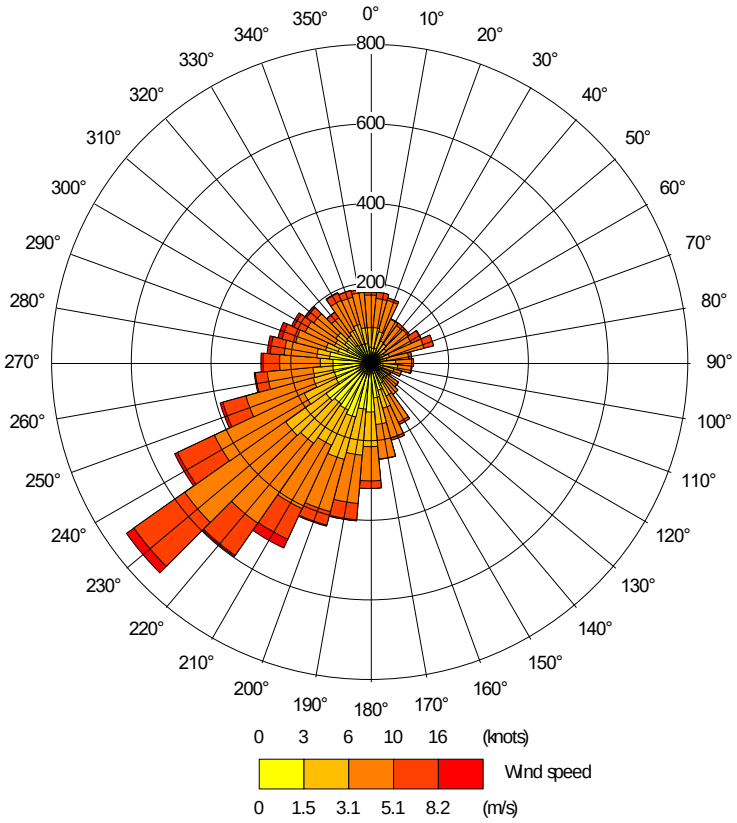

Figure A Error! No text of specified style in document.**.3: East Malling 2019 Wind Rose**

Table A Error! No text of specified style in document.**.2: Summary Model Inputs**

Model Parameter	Value Used
Terrain Effects Modelled?	Yes – 6 km x 6 km Cartesian grid at 50m resolution
Variable Surface Roughness File Used?	Yes – 6 km x 6 km Cartesian grid at 50m resolution
Urban Canopy Flow Used?	No
Gradients Modelled?	Yes
Advanced Street Canyons Modelled?	Yes
Noise Barriers Modelled?	No
Meteorological Monitoring Site	East Malling
Meteorological Data Year	2019
Dispersion Site Surface Roughness Length (m)	Variable
Dispersion Site Minimum MO Length (m)	30
Met Site Surface Roughness Length (m)	0.1
Met Site Minimum MO Length (m)	1

Model Verification

In order to ensure that ADMS-Roads accurately predicts local concentrations, it is necessary to verify the model against local measurements. The model has been run to predict the annual mean concentrations during 2019 at the CM3 automatic monitor, and Maid19, Maid53, Maid56, Maid81,

Maid96, Maid98, Maid111, Maid122, Maid123, Maid127 and Maid132 diffusion tube monitoring sites. The locations of the monitoring sites are shown in **Figure 3**.

Most nitrogen dioxide (NO_2) is produced in the atmosphere by reaction of nitric oxide (NO) with ozone. It is therefore most appropriate to verify the model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2).

The model output of road-NOx (i.e., the component of total NOx coming from road traffic) has been compared with the 'measured' road-NOx. Measured road-NOx has been calculated from the measured NO_2 concentrations and the predicted background NO_2 concentration using the NOx from NO_2 calculator (Version 8.1) available on the Defra LAQM Support website.

The unadjusted model has under predicted the road-NOx contribution at several monitoring locations; this is a common experience with this and most other road traffic emissions dispersion models. An adjustment factor has been determined as the slope of the best-fit line between the 'measured' road contribution and the model derived road contribution, forced through zero (Figure AError! No text of specified style in document.**.4**). The calculated adjustment factor of **2.0792** has been applied to the modelled road-NOx concentration for each receptor to provide adjusted modelled road-NOx concentrations.

The total nitrogen dioxide concentrations have then been determined by combining the adjusted modelled road-NOx concentrations with the predicted background NO_2 concentration within the NOx to NO_2 calculator. Figure AError! No text of specified style in document.**.5** compares final adjusted modelled total NO_2 at each of the monitoring sites to measured total NO_2.

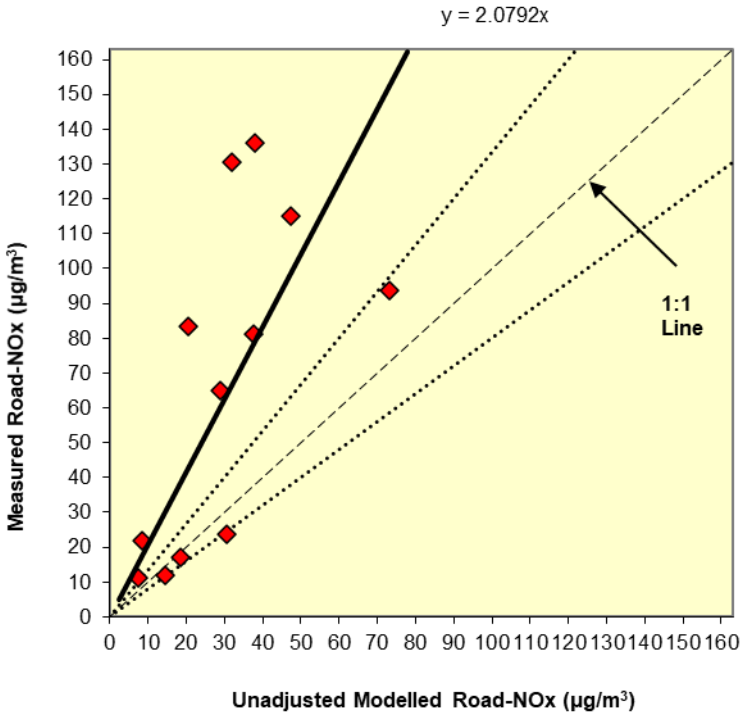

Figure A Error! No text of specified style in document.**.4: Comparison of Measured Road NOx to Unadjusted Modelled Road NOx Concentrations. The dashed lines show ± 25%.**

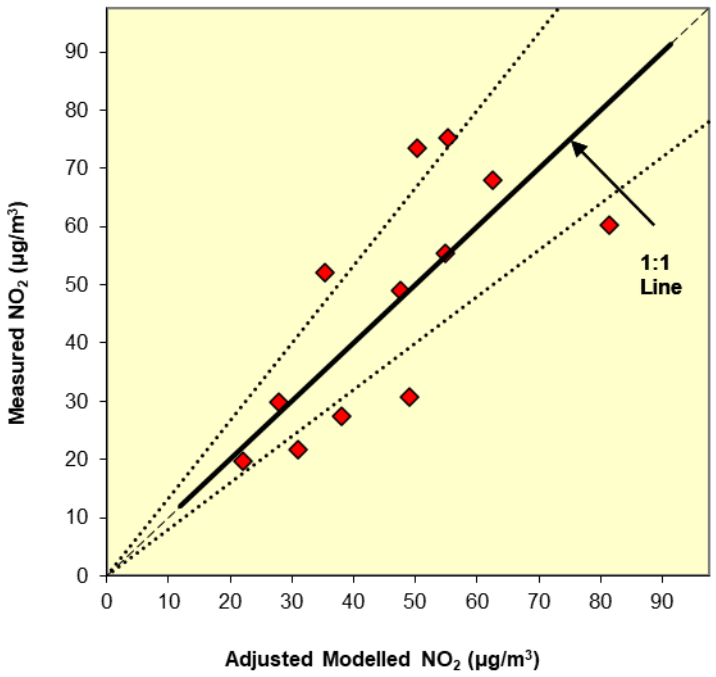

Figure A Error! No text of specified style in document.**.5: Comparison of Measured Total NO_2 to Final Adjusted Modelled Total NO_2 Concentrations. The dashed lines show ± 25%.**

Table AError! No text of specified style in document.**.3** shows the statistical parameters relating to the performance of the model, as well as the 'ideal' values (Defra, 2021a). There is a large degree of scatter within the model results, as demonstrated by the high RMSE presented in Table AError! No text of specified style in document.**.3**. This is likely to be due to the uncertainty in the traffic data used within the model. However, the fractional bias is close to zero, indicating that the overall adjustment factor is appropriate for this data set.

Table A Error! No text of specified style in document.**.3: Statistical Model Performance**

Statistical Parameter	Model-Specific Value	'Ideal' Value
Correlation Coefficient [a]	0.72	**1**
Root Mean Square Error (RMSE) [b]	13.65	**0**
Fractional Bias [c]	0.01	**0**

[a] Used to measure the linear relationship between predicted and observed data. A value of zero means no relationship and a value of 1 means absolute relationship.

[b] Used to define the average error or uncertainty of the model. The units of RMSE are the same as the quantities compared (i.e., µg/m^3). TG16 (Defra, 2021a) outlines that, ideally, a RMSE value within 10% of the air quality objective (4 µg/m^3) would be derived. If RMSE values are higher than 25% of the objective (10 µg/m^3) it is recommended that the model is revisited.

[c] Used to identify if the model shows a systematic tendency to over or under predict. Negative values suggest a model over-prediction and positive values suggest a model under-prediction.

Post-processing

The model predicts road-NOx concentrations at each receptor location. These concentrations have been adjusted using the adjustment factor set out above, which, along with the background NO_2, has been processed through the NOx to NO_2 calculator available on the Defra LAQM Support website. The traffic mix within the calculator has been set to “All other urban UK traffic”, which is considered suitable for the study area. The calculator predicts the component of NO_2 based on the adjusted road-NOx and the background NO_2.

Review of 20 mph Speed Limits

One option being discussed for Upper Stone Street is a 20 mph speed limit. Because the changes are unlikely to have a large impact on overall average speed, but instead impact on stop start traffic, modelling using ADMS and average speed emission factors is unlikely to provide a robust assessment. An assessment could be undertaken using a microsimulation traffic model, however, at this stage it is considered that a better use of budget would be to undertake a brief literature review of all peer reviewed studies which have been undertaken to look at the impacts of 20 mph speed limits on emissions in different settings. This is provided below.

Previous applications and assessments of 20 mph speed limits in other UK locations have focused on reporting the wider implications of such schemes, such as reduced fatal injuries (Bornioli et al., 2020; Grundy et al., 2009), increased modal shift to active travel alternatives (Pilkington et al., 2018; Cairns et al., 2014; Warrington Borough Council, 2010), and decreased health inequalities (Dorling, 2014). The following paragraphs are, however, focused specifically on implications for road traffic emissions due to changes in the speed limit, and no other traffic calming methods.

There are numerous ways to estimate emissions from a fleet of vehicles including modelling and measurements. Those discussed here are based on modelling, and can be summarised by the umbrella terms of: average-speed based models and instantaneous (or modal) models.

The UK National Atmospheric Emissions Inventory (NAEI) provides the relationship between speed and emission factor for both NOx and $PM_{2.5}$, available at: https://naei.beis.gov.uk/data/ef-transport, which are based on relationships within COPERT[9]. This method is based on the measurement of emissions over both pre-determined drive-cycles in a laboratory, and real-world driving emission measurements, the average speed of which is determined, and corresponding tailpipe emission rate assigned. The drive-cycles are completed for multiple vehicle types, Euro classes, and fuels. Using an average-speed method, for example in models used for Local Air Quality Management, such as this study, would always predict larger emissions by lowering the speed limit from 30 mph to 20 mph due to a decrease in operational engine efficiency. However, this assumes that vehicles are already travelling relatively freely at 30 mph, and would subsequently travel freely at 20 mph, which is unlikely to be the case in an urban environment.

Research has shown that prior to the implementation of 20 mph limits in other UK locations, vehicles were, on average, travelling below the 30 mph speed limit, for example, 25.1 mph in Calderdale (Calderdale Council, 2018). After 20 mph limits (sign only) were in place, typically measured speeds only reduced by an incremental amount: 2.7 mph in Bristol (Pilkington et al., 2018), 1.9 mph in Calderdale (Calderdale Council, 2018), and 1.4 mph in Birmingham (Birmingham City Counil, 2018).

Furthermore, the average-speed approach neglects driving dynamics, such as short-lived acceleration and deceleration events where large proportions of emissions occur. Direct measurements of vehicle speeds and exhaust emissions have found that acceleration and deceleration events are reduced in

[9] COPERT is a software tool developed by the European Environment Agency and is used widely to calculate national emissions from road transport in Europe

magnitude in 20 mph (European equivalent) limit zones, and therefore emissions of NOx and $PM_{2.5}$ reduce (Casanova and Fonseca, 2012).

Changes in such dynamics cannot be assessed by the average-speed methodology, but can be by instantaneous emissions models which account for vehicle specific power and engine load. AQC (2014) and Williams and North (2013) applied the AIRE emissions model to assess the potential impacts of 20 mph speed limits. Both studies suggest that lower speed limits have the potential to reduce NOx emissions from road transport through smoother vehicle flows and less overall speed variation, the opposite conclusion than that of the average-speed based methodology.

Other local factors are also likely to have an influence on the net change in emissions due to the introduction of a 20 mph speed limit. Most previous studies have used passenger cars to measure or model outcomes, but if the fleet is dominated by HGVs these vehicles are likely to have a different emissions profile with changes to speed and acceleration. Additionally, road gradients also play an important role in vehicle emissions (Kean et al., 2003), but are yet to be fully investigated in relation to changes at lower speeds. Gradient is likely to be a major contributing factor on Upper Stone Street.

Overall, it still remains uncertain whether a 20 mph limit is likely to reduce road transport emissions. It is generally accepted that approaches which account for the impacts on overall vehicle flow and frequency of acceleration and deceleration events are likely to be more representative of real-world driving patterns than the average-speed approach (Davis, 2018). However, local factors such as the fleet mix and road gradient are also likely to play an important role in determining net emissions.

Therefore, for Upper Stone Street, although there is not clear evidence around the impacts of a 20 mph speed limit, it is judged that it is not likely to worsen air quality, and may provide some benefits, although these are unlikely to be measurable through monitoring.

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

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