EssexAir

Essex Air Quality Strategy

Supporting information

July 2025

This strategy has been developed collaboratively by representatives from the following councils in Essex:

The strategy is also supported by the following anchor partner organisations:

The Essex Air Quality Strategy has been jointly developed by all of the district, borough and city councils in Essex, as well as Essex County Council and the two unitary councils, Southend and Thurrock. We work together as part of the Essex Air Quality Consortium, under the banner of EssexAir, to improve air quality.

While we acknowledge the proposals for local government reorganisation in Essex, regardless of the potential future make-up of local government in Essex, there remains significant support for a new Essex Air Quality Strategy. It is felt there will still be a need for local authorities in Essex to work collaboratively on the subject of air quality to ensure maximum impact and make best use of the collective resources available.

A number of the councils already have local air quality action plans or strategies. The new Essex Air Quality Strategy aims to complement these and provide an overarching strategy for the whole county. The local air quality action plans and strategies are available in the local authorities section of the EssexAir website.

This supporting information document provides background information, describes the current air quality situation in Essex and how air quality is expected to change in the future, and identifies potential opportunities to improve air quality. It is intended for those who want to know about air quality in Essex in greater detail.

There are two further documents aligned to the Essex Air Quality Strategy:

1. Essex Air Quality Strategy: a summary document which is intended for all audiences. It gives a high level summary of the reasons why action is needed, what is already being done to improve air quality in Essex and the actions we propose to take to further improve air quality.
2. Action plan: outlines the actions we propose to take to improve air quality and how progress will be measured. The action plan will be a live document, which will be updated as needed.

All three documents are available online at: www.essexair.org.uk/strategy

Through a public consultation from January to March 2025, we asked for feedback on a draft version of the Essex Air Quality Strategy. We have used this feedback to help us improve and finalise the strategy.

Essex Air Quality Strategy

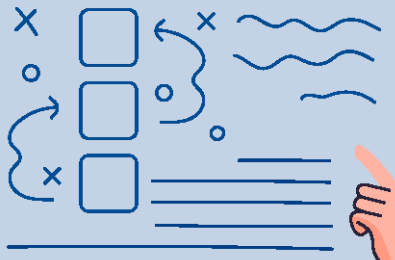
A simple, high-level summary

Supporting Information
(this document)

Provides further background and detail

Action Plan

Describes the actions we will take to improve air quality in Essex



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Introduction

Why have we produced this strategy?

Air quality is an important issue for Essex County Council (ECC) and each of the district, borough and city councils and unitary authorities (i.e. Thurrock Council and Southend Council) in Essex. There is growing evidence about the effects poor air quality has on human health, with increasing concern about the impacts of fine particulate matter ($PM_{2.5}$), as well as nitrogen dioxide (NO_2).

Everyone's Essex[1], ECC's plan for levelling up the county 2021–2025, includes the commitment to "*help all our communities to enjoy a high-quality environment … by reducing air pollution*". This strategy builds upon and supports this commitment, as well as the air quality related plans and strategies developed by each of the district, borough and city councils and unitary authorities in Essex.

Managing local air quality is primarily the role of district, borough and city councils and unitary authorities, but as air pollution crosses boundaries and we know road transport is one of the biggest contributors to poor air quality for key air pollutants such as NO_2 and $PM_{2.5}$, ECC also has a clear role to play.

The intention is therefore to work together, sharing our understanding, resources and best practice to help achieve the best outcomes.

Key air quality issues in Essex

The air quality hotspots identified within Essex to date (see Current Situation) are associated with the pollutant NO_2, with concentrations heavily influenced by road transport exhaust emissions. As the local highway authorities, ECC, Thurrock Council and Southend Council can influence the way the highway network is used and, by doing so, reduce road traffic emissions from the roads under its jurisdiction. In some hotspots, this may involve implementing targeted air quality interventions to reduce NO_2 concentrations.

However, the majority of health impacts from air pollution are associated with concentrations of $PM_{2.5}$, and future air quality policy in the UK will be focussed on reducing concentrations of (and exposure to) this pollutant[2]. Concentrations of $PM_{2.5}$ are influenced by a wide range of emission sources, both local, regional, and further afield, with road traffic emissions making a much smaller contribution than for NO_2 (see Sources of Air Pollution). A combination of local, national, and international actions targeting a wide range of emission sources will be required to reduce concentrations of this pollutant. This makes the challenge of reducing $PM_{2.5}$ concentrations more like that for greenhouse gases and climate change, than for reducing roadside NO_2 concentrations in specific locations. Actions aimed at reducing emissions of $PM_{2.5}$ in Essex, which are also included within this strategy, are therefore more wide-ranging, cover a large geographical area and seek to achieve a gradual reduction in emissions over the longer term.

It is also noted that while electric vehicles have zero exhaust emissions (therefore reducing NO_2 concentrations), they still result in emissions of $PM_{2.5}$ from brake, tyre and road surface wear. Although the continuing uptake of such vehicles will benefit air quality, as well as reduce emissions of greenhouse gases, they are not 'zero' emission.

Furthermore, and as in other parts of the UK, a substantial number of new houses are planned to be built in Essex in the coming years, which, together with other development, could negatively impact air quality (e.g. as a result of additional road traffic or heating emissions). It is therefore important that a proactive approach is taken in order to avoid such impacts (e.g. through planning processes and good design).

ECC are developing a new Local Transport Plan (LTP) for Essex, which will be both informed by and supportive of this strategy. Southend Council and Thurrock Council are also in the process of producing an updated LTP and Transport Strategy, respectively.

Roles and responsibilities

The Air Quality Strategy for England[3] sets out the strategic framework for managing air quality in England, including relevant powers, responsibilities, and further actions.

The UK Government is ultimately responsible for achieving national legally-binding air quality Limit Values and Targets, with responsibilities devolved to local authorities[1] (rather than county councils) in terms of achieving national Air Quality Objectives through a process known as Local Air Quality Management (LAQM).

The existing LAQM framework is summarised in the Air Quality Strategy for England[3], which indicates that local authorities must:

- assess air quality in their area for the specified pollutants and submit Annual Status Reports
- declare an Air Quality Management Area (AQMA) if concentrations are above Air Quality Objectives
- develop an Air Quality Action Plan for each AQMA, setting out measures to fix the problem, and dates by which they will be carried out

However, where exceedances of Air Quality Objectives are associated with an emission source within the control of another body, such as a neighbouring local authority, a county council, the Environment Agency or National Highways, such bodies can be legally required to implement improvement measures (e.g. where air quality issues are attributable to road traffic emissions, the measures required to resolve these issues typically need to be implemented by the relevant highway authority).

The Air Quality Strategy for England[3] also indicates that all local authorities are expected to take proactive action to improve air quality, whether or not they have an AQMA and that local authorities without an AQMA should specify proactive measures they will take in an Air Quality Strategy. It is also stated that:

"As well as meeting local objectives, local authorities play a role in contributing to national targets. The government recognises that as a regional pollutant, many of the sources of $PM_{2.5}$ are outside of local authority control. However, there are sources of $PM_{2.5}$ over which local authorities do have control. Therefore, while $PM_{2.5}$ is not currently part of the Local Air Quality Management framework, the government still expects all local authorities to effectively use their powers to reduce $PM_{2.5}$ emissions from the sources which are within their control."

ECC supports the UK Government and the relevant district / borough / city councils to identify, assess and implement measures aimed at improving local air quality. As unitary authorities, Thurrock Council and Southend Council are responsible for manging air quality in their areas.

Timescales and future updates

This strategy initially focusses on actions we will take over the five-year period between 2025 and 2029. This is considered a reasonable time period for actions to improve air quality to be implemented and progress to be measured. It will be important, however, that the strategy is kept under review to take account of new information, guidance and policy, and to ensure the actions within the strategy remain appropriate.

This strategy has a strong focus on road traffic emissions and the pollutant NO_2, due to the air quality issues identified in Essex to date (see Current Situation). However, a range of other emission sources have also been considered, where appropriate, with the aim of reducing concentrations of (and exposure to) $PM_{2.5}$.

[1] The lower tier in two-tier areas (i.e. district, borough, or city councils) and unitary authorities (e.g. Thurrock Council and Southend Council).

Pollutants of concern

Particulate matter (PM) and nitrogen dioxide (NO_2) are both major components of urban air pollution and are usually the air pollutants of greatest concern in the UK. This is because, historically, concentrations of NO_2 have exceeded relevant air quality standards in many urban areas, and in some areas still do, while the strongest evidence for the effects of air pollution on health is for PM[4].

Nitrogen dioxide

NO_2 is a gas that is produced along with nitric oxide (NO) by combustion processes, e.g., burning of fossil fuels. Together they are often referred to as oxides of nitrogen (NO_X). The Department for Environment, Food and Rural Affairs (Defra) estimated that in the UK road transport was responsible for 70% of roadside NO_X in 2021[5]. Other sources include power generation, industrial processes, and domestic heating.

Short-term exposure to high levels of NO_2 can cause inflammation of the airways and increase susceptibility to respiratory infections and to allergens. As such, it makes the symptoms of those who already suffer from lung or heart conditions worse. Over the longer term, studies have linked NO_2 in outdoor air with reduced lung development and respiratory infections in early childhood and effects on lung function in adulthood, as well as other adverse effects on health, including reduced life expectancy[6]. As road traffic is a notable source of NO_2, as well as PM, it has made it difficult to distinguish the effects seen in epidemiological studies for NO_2 from those of PM (for which there is more direct evidence – see below). However, the evidence associating NO_2 with health effects continues to grow.

Deposition of nitrogen to the environment, both directly from the air and through rainfall, can also change soil chemistry, affecting vegetation and subsequently biodiversity in sensitive habitats.

Particulate matter

Particulate matter is a generic term used to describe a complex mixture of solid and liquid particles of varying size, shape, and composition, i.e. everything in the air that isn't a gas. Some particles are emitted directly (primary PM), while others are formed in the atmosphere through complex chemical reactions (secondary PM). The main sources of man-made particulate matter are the combustion of fuels by vehicles, industry and domestic properties, and other physical processes, such as tyre and brake wear. Natural sources include wind-blown soil and dust, sea spray particles, and smoke from fires.

As shown in **Figure 1**, particulate matter is often classified according to its size and referred to as:

- coarse particles (PM_{10}; particles that are less than 10 microns (µm) in diameter)
- fine particles ($PM_{2.5}$; particles that are less than 2.5 µm in diameter)
- ultrafine particles ($PM_{0.1}$; particles that are less than 0.1 µm in diameter)

Particulate matter can enter the lungs and blood and be transported around the body, lodging in the heart, brain and other organs.

Particulate matter can have short-term health impacts over a single day when concentrations are very high, and long-term impacts from exposure to lower concentrations over a lifetime. Adverse effects can be greater for certain more vulnerable people, including young children, the elderly, and those suffering from breathing problems like asthma. PM_{10} is mainly deposited in the nose or throat, whereas $PM_{2.5}$ poses the greatest risk because it can be drawn deeper into the lungs, is less easily dispelled by the body and can even pass into the bloodstream. The strongest evidence for effects on health is associated with fine particles ($PM_{2.5}$)[2].

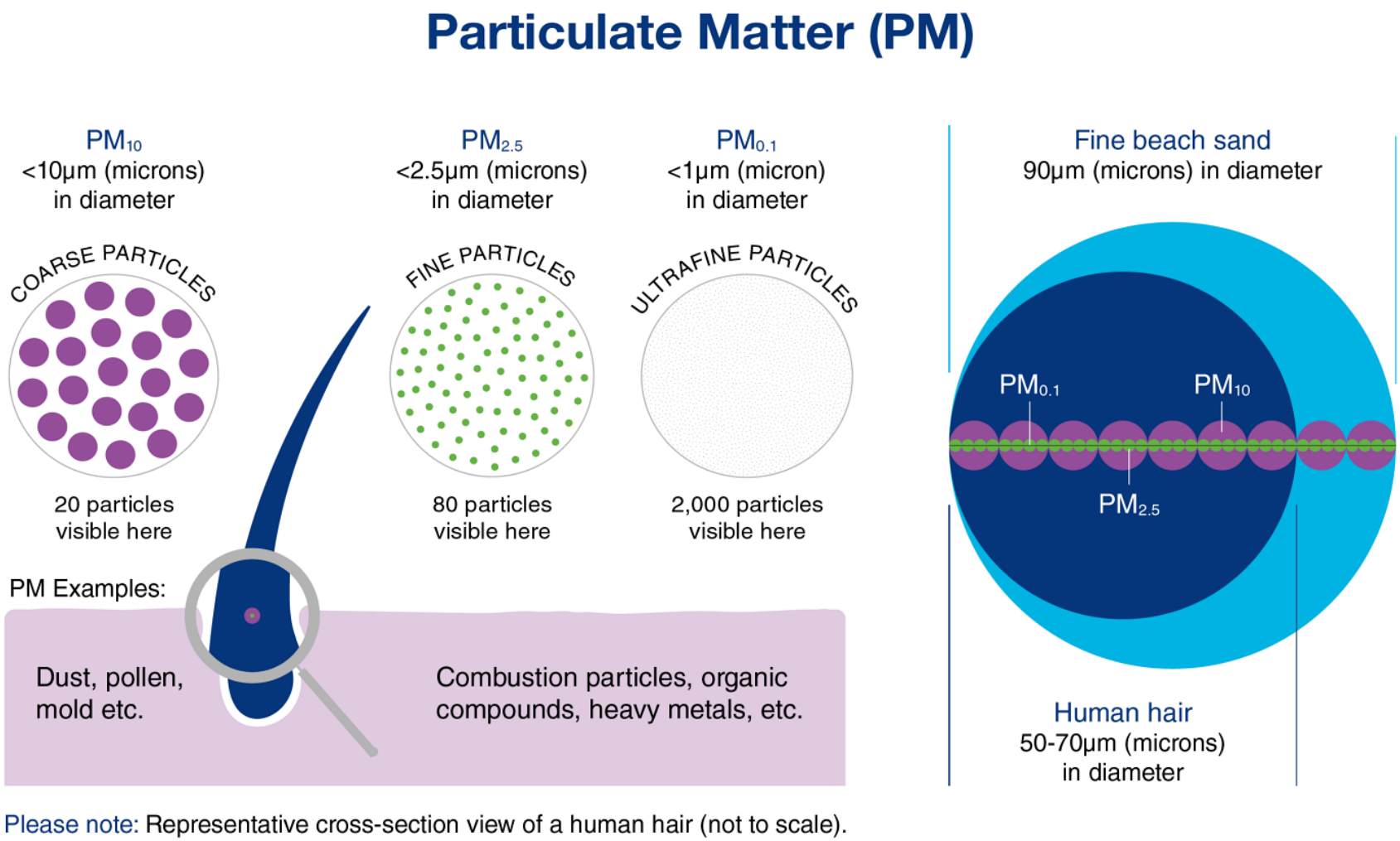

Figure 1 Different sizes of particulate matter

Sources of air pollution

Air pollutants are emitted from a range of both man-made and natural sources, as illustrated in **Figure 2**. Many everyday activities, such as transport, industrial processes, farming, energy generation and domestic heating, can have a negative effect on air quality.

$PM_{2.5}$ can come from natural sources such as pollen, sea spray and desert dust, and human made sources such as smoke from fires, emissions from vehicle exhausts, dust from tyres and brakes, as well as emissions from industry. Particles emitted directly from such sources are called primary PM. Secondary PM is formed in the atmosphere through chemical reactions between other air pollutant gases such as nitrogen oxides (NO_X), ammonia (NH_3) and sulphur dioxide (SO_2). Around two thirds of $PM_{2.5}$ concentrations in Essex are estimated to be attributable to secondary PM[7].

Both PM and other pollutants that can form it can travel large distances in the atmosphere. A small proportion of the concentrations of PM that people in Essex are exposed to come from naturally occurring sources such as pollen and sea spray (approximately 15%). Another third is transported to Essex from other European countries. However, around half of Essex concentrations of PM comes from man-made sources in the UK such as wood burning, and tyre and brake wear from vehicles[8].

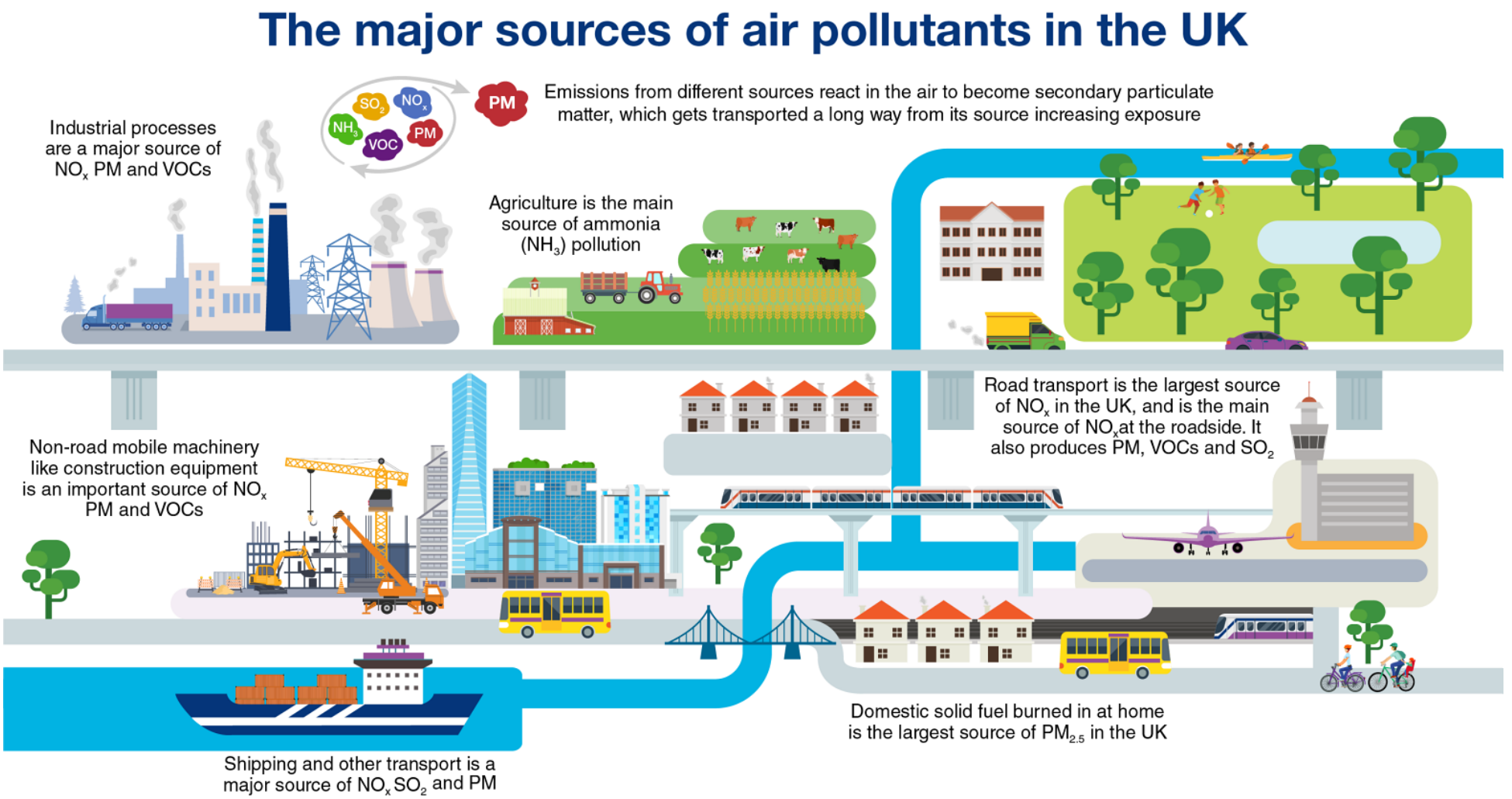

Figure 2 Sources of air pollutant emissions

Road transport

Emissions of NO_X from road traffic make the largest contribution (on average 70%[9]) to NO_2 concentrations at the roadside, where concentrations of this pollutant are highest. Across Essex as a whole, and as shown in **Figure 3**, road transport is estimated to have contributed approximately 49% of NO_X emissions in 2021[10]. PM emissions from road traffic make a much smaller, albeit important, relative contribution to $PM_{2.5}$ concentrations at the roadside, and in urban areas more generally. In 2021, for example, road transport is estimated to have contributed approximately 16% of $PM_{2.5}$ emissions in Essex[11].

Road traffic PM emissions occur as a result of exhaust emissions, as well as brake and tyre wear, road surface wear and resuspended road dust (collectively termed non-exhaust emissions). Road traffic PM exhaust emissions have, however, reduced rapidly in recent years due to improved emissions controls, meaning that non-exhaust emissions of PM already comprise the majority of PM_{10} and $PM_{2.5}$ emissions from road transport[12].

Diesel vehicles have higher NO_X emissions than petrol vehicles and emit a greater proportion of NO_X directly as NO_2, meaning diesel cars and LGVs tend to make a larger contribution to roadside NO_2 concentrations than other vehicles. While electric vehicles do not have exhaust emissions, they still generate non-exhaust PM emissions as a result of brake and tyre wear, so are not 'zero emission'. The electricity consumed by electric vehicles also ultimately results in some greenhouse gas emissions, albeit such emissions are decreasing over time as the national grid is increasingly decarbonised.

Other sources

As shown in **Figure 3**, NO_X emissions from combustion in industry (15%), non-road transport (e.g. rail and aviation) and mobile machinery (13%) and commercial, institutional, residential and agricultural combustion (12%) are estimated to have contributed approximately 40% of NO_X emissions in Essex in 2021. Other emission sources, including permitted industrial and commercial emission sources and agriculture, forestry and land use change, contributed the remaining (11%)[10].

Commercial, institutional, residential and agricultural combustion is estimated to be a major source of PM emissions, accounting for approximately 32% of $PM_{2.5}$ emissions in Essex in 2021[11]. Most emissions from this source come from households burning wood in closed stoves and open fires[8]. Emissions of $PM_{2.5}$ from domestic wood burning are estimated to have increased by 124% between 2011 and 2021[8].

The burning of fuel used on industrial sites, either to generate energy or to provide heat to industrial processes, is also a major source of PM emissions, and is estimated to have accounted for 29% of $PM_{2.5}$ emissions in Essex in 2021[11]. The remaining 23% of $PM_{2.5}$ emissions in Essex in 2021 are attributable to a range of different emission sources including waste treatment and disposal (6%) and production processes including construction (6%).

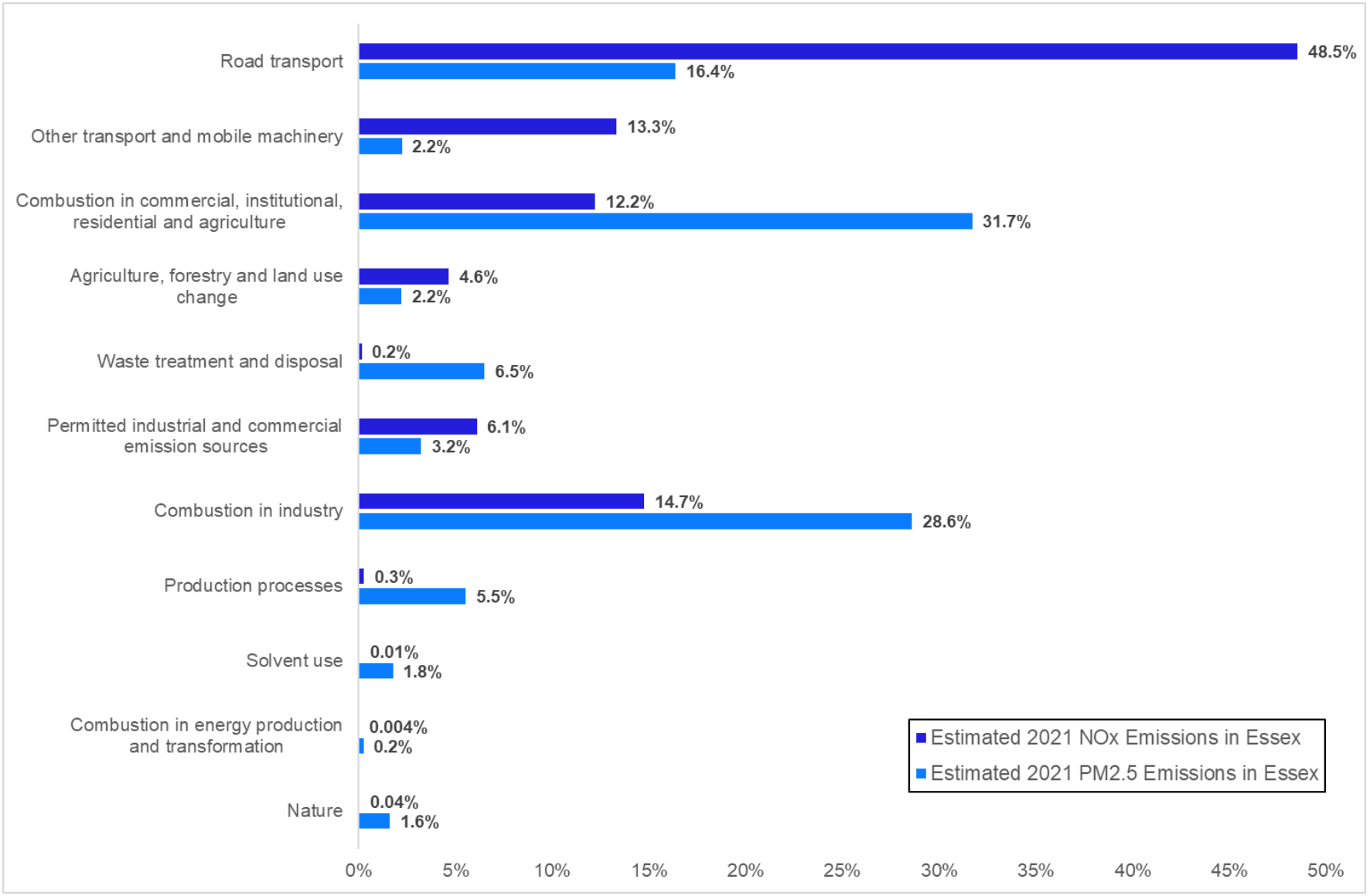

Figure 3 Estimated relative contributions of different sources to emissions of NO_X[10] and $PM_{2.5}$[11] in Essex in 2021

Indoor air quality

Air quality standards in the UK are defined for ambient (i.e. outdoor) locations where air quality can be readily monitored and assessed. However, the majority of people's time in the UK (potentially 80-90%) is spent indoors, meaning that indoor air quality is particularly important. Indoor air quality is not only affected by the quality of the outdoor air which enters buildings (e.g. throughs doors, windows or other gaps), but also by indoor air pollution sources. These sources include NO_X and PM emissions from gas and solid fuel combustion (e.g. for cooking and heating). Other sources include volatile organic compounds released from buildings materials, furnishings and during the use of solvent-containing products, and the use of consumer products (e.g. cleaning and personal care products). Mould and damp can also lead to elevated concentrations of biological aerosols including PM.

As shown in **Figure 4**, indoor air quality can, however, be improved by increasing ventilation and reducing indoor emissions of air pollutants. It is recognised, however, that affordability may be a barrier to effective and efficient heating and ventilation (e.g. opening windows to improve ventilation may result in increased heating costs). The shift to Net Zero Carbon (in operation) for new developments will include measures aimed at achieving high standards of air-tightness (to avoid heat loss), thereby reducing occupants' exposure to outdoor air pollutants. However, in the absence of appropriate ventilation, this could potentially increase exposure to indoor air pollutants.

While the focus of this strategy is on improving outdoor air quality by reducing emissions from sources over which we have direct influence, we will also seek to raise awareness of the importance of indoor air quality across Essex and the actions individuals and organisations can take to improve it, such as retrofitting and improving the fabric efficiency within buildings and the installation of low carbon heating options.

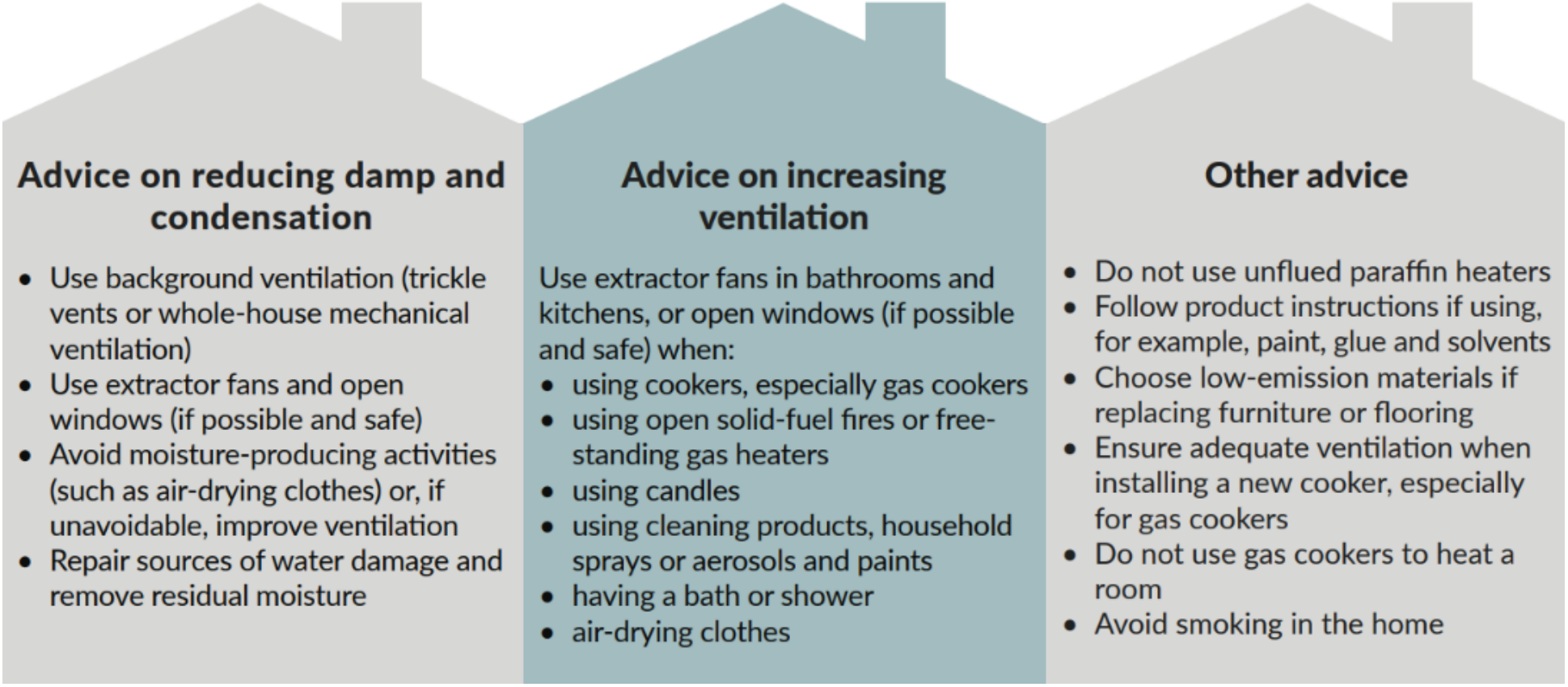

Figure 4 Actions which can be taken to improve indoor air quality

SOURCE: National Institute for Health and Care Excellence (NICE)[13]

Links to climate change

Air quality and climate change are inherently linked because air pollutants are frequently emitted at the same time as greenhouse gases, such as carbon dioxide (CO_2), which contribute to climate change. This is particularly true for road traffic emissions, which are a major source of both oxides of nitrogen (NO_X) (an air pollutant and precursor for nitrogen dioxide (NO_2)), as well as CO_2. Actions taken to reduce emissions of CO_2 will therefore also typically benefit air quality and vice versa.

For example, 'Net Zero: Making Essex Carbon Neutral'[14] and the associated Essex Climate Action Plan[15] set out a number of recommendations and actions for Essex to be net zero by 2050. These include measures to reduce greenhouse gas emissions from land use (including agriculture), energy generation, buildings, transport and waste, many of which will also reduce emissions of air pollutants in Essex. Examples of actions aimed at reducing greenhouse gas emissions which will also benefit air quality include:

- Tree planting as part of the Essex Forest Initiative[16], as trees have the potential to capture particulate matter on their leaf surfaces
- Supporting the transition to low carbon energy and encouraging renewable energy generation (such as solar power), which will reduce emissions to air associated with electricity generation
- Helping local residents, businesses and public sector organisations to install low carbon heating such as heat pumps and other energy efficiency measures, which will reduce emissions to air associated with the combustion of fossil fuels for heating
- New net zero carbon (in operation) development throughout the county will include measures aimed at achieving high standards of air-tightness (to avoid heat loss), thereby reducing occupants' exposure to outdoor air pollutants

Other plans, strategies and actions specifically aimed at reducing greenhouse gas emissions, which are likely to have a positive influence on air quality in Essex include:

- The Department for Transport's (DfT) Transport Decarbonisation Plan[17], which sets out the Government's commitments and the actions needed to decarbonise the entire transport system in the UK
- Transport East's Transport Strategy[18], of which decarbonising transport is one of four strategic priorities
- ECC's emerging Local Transport Plan 4 (LTP4), which is currently under development, with decarbonisation being an important aspect across the three key themes in the emerging LTP4
- ECC's Phase 1 Essex Electric Vehicle Infrastructure Strategy[19]
- The establishment of a robust evidence base and development of a consistent planning policy approach which requires all new homes and buildings to be net zero carbon in Essex[20]
- The inception of a dedicated Climate and Planning Unit (CaPU) to provide advice and guidance to district, borough and city councils to help ensure all new buildings are built to a net zero carbon in operation standard that aligns with our climate targets

Each of these plans, strategies and actions include measures to either increase cycling and walking and the use of public transport as alternatives to the use of private cars, and/or to accelerate the decarbonisation of vehicles and buildings in Essex, which will also improve air quality.

However, these measures are not aimed at reducing emissions and, therefore, improving air quality in a specific location, but rather across the country, region or county as a whole. While they are likely to result in a general improvement in air quality, measures aimed at improving air quality in specific

locations (e.g. where exposure to air pollution is highest) are still likely to be required.

Many of these strategies are also focused on reducing emissions over the longer term (i.e. by 2050), and whilst some reductions will occur over the short to medium term, improvements in air quality are needed in some areas of Essex over much shorter timescales.

It should also be noted that changes in climate also have the potential to affect air quality. For example, longer dry spells and higher temperatures during summer months have the potential to result in more wildfires (which result in particulate matter emissions), as well as the formation of ground-level ozone (which is an air pollutant that can affect people's heath)[21].

Legislative and policy context

Key legislation, policy and strategies at a national, regional and local level which influence air quality in Essex are summarised in **Figure 6**. These include those relating specifically to air quality, but also those relating to climate change (see section on Links to Climate Change above), transport and development planning.

Air quality management

There are essentially three air quality management regimes in the UK, and therefore it is important to recognise the difference between Air Quality Objectives, air quality Limit Values and air quality Targets. Some key differences are described in **Table 1**.

Because of these differences, there are many locations across the UK (and within Essex) where national assessments of compliance with air quality Limit Values and Targets, and local authority assessments of compliance with Air Quality Objectives, are not in agreement. For example, there are locations where Air Quality Objectives are achieved, but compliance with the Limit Values is not and vice versa.

Local Air Quality Management

The Environment Act 1995[22] introduced a system of Local Air Quality Management (LAQM) in the UK. This requires district / borough / city councils to review and assess air quality within their boundaries regularly and systematically against Air Quality Objectives and, where these are exceeded, to declare an Air Quality Management Area (AQMA) and make Air Quality Action Plans (AQAPs) to meet the Air Quality Objectives.

Those authorities who have not had to designate AQMAs and produce AQAPs are required to draw up a local Air Quality Strategy.

Environment Act 2021

The Environment Act 2021[23] includes a number of amendments to the LAQM process under Schedule 11. These amendments include the introduction of a legal duty for air quality partners (e.g. county councils and National Highways) to co-operate in the LAQM process and state that, when notified by a district council that an AQAP is being prepared, county councils "*must, before the end of the relevant period, provide the district council with proposals for particular measures the county council will take to contribute to the achievement, and maintenance, of air quality standards and objectives in the area to which the plan relates.*"

Local Air Quality Plans

To achieve national compliance with air quality Limit Values, the Secretary of State has issued a number of Ministerial Directions to various UK local authorities, including Basildon Borough Council and ECC. These Ministerial Directions, which are legally binding, require the relevant local authorities to develop and implement a plan for achieving air quality Limit Values in their areas in the shortest possible time.

	Air Quality Objectives	Air Quality Limit Values	Air Quality Targets
Who is responsible?	District / borough / city councils	The UK Government	The UK Government
What needs to be done?	Work towards achievement	Must be achieved in shortest possible time	Must be achieved by the end of 2040
Where are they assessed?	Locations of relevant exposure (e.g. residential properties)	Any relevant location where there is public access (e.g. along footpaths)	At relevant air quality monitoring stations
How are they assessed?	By monitoring and modelling undertaken by district / borough / city councils at a local level	By monitoring and modelling undertaken by the UK Government at a national level, supplemented by local modelling and/or monitoring where exceedances are identified	By air quality monitoring undertaken by the UK Government at a national level

Table 1 Key differences between Air Quality Objectives, Limit Values and Targets

Air quality standards

Levels of air pollutants are assessed by determining their concentration, i.e., the mass of a particular pollutant in a given volume of air. In the UK, the units which are typically used to quantify pollutant concentrations are microgrammes, i.e., one millionth of a gramme, per cubic meter of air ($\mu g/m^3$).

Air quality is assessed by monitoring and/or modelling levels of air pollutants at a particular location (e.g., a residential property) and comparing them to relevant air quality standards. Air quality standards are concentrations recorded over a given time period (e.g., a day or year), which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health or the environment, that can realistically be achieved in terms of reductions in emissions and prevailing environmental conditions.

Air quality standards currently applicable in the UK for NO_2 and PM are set out in **Table 2**. The Air Quality Objectives for NO_2 and PM_{10} were legislated for almost 25 years ago in the Air Quality (England) Regulations 2000[24] and the air quality Limit Values for NO_2 and PM_{10} almost 15 years ago in the Air Quality Standards Regulations 2010[25].

Standards have also been set for other pollutants, such as sulphur dioxide (SO_2), however, these are usually met in the UK, so have not been presented here.

Pollutant / Standard	Concentration Threshold	Averaging Period
Nitrogen dioxide (NO_2) Air Quality Objective / Limit Value	40 µg/m^3	Annual mean
	200 µg/m^3	1-hour mean, not to be exceeded more than 18 times per year
Particulate matter (PM_{10}) Air Quality Objective / Limit Value	40 µg/m^3	Annual mean
	50 µg/m^3	24-hour mean, not to be exceeded more than 35 times per year
Particulate matter ($PM_{2.5}$) Air quality Limit Value	20 µg/m^3	Annual mean

Table 2 National Air Quality Objectives and Limit Values for the protection of human health

Air quality targets

The Environment Act 2021[23] placed a duty on the Secretary of State for Environment, Food and Rural Affairs to set at least two further legally binding long-term targets for air quality. These targets, which were set in January 2023[26], are:

- an annual mean target of 10 µg/m^3 for $PM_{2.5}$ (to be met by the end of 2040), which is 50% of the current air quality Limit Value
- at least a 35% reduction in population exposure to $PM_{2.5}$ by the end of 2040 compared to 2018 levels

The Environment Improvement Plan 2023[2] also set the following related interim targets:

- an annual mean target of 12 µg/m^3 for $PM_{2.5}$ (to be met by the end of January 2028), which is 60% of the current air quality Limit Value
- at least a 22% reduction in population exposure to $PM_{2.5}$ by the end of January 2028 compared to 2018 levels

Roles and responsibilities for achieving these targets at a local level are, however, yet to be established.

Potential future air quality standards?

In 2021, the World Health Organization (WHO) updated its air quality guidelines[27] for the first time since 2006, based on the latest evidence of the health impacts of air pollution. These guideline values are intended to influence the policy of national governments going forwards, although it is recognised that it may not always be possible to meet them in all situations. As shown in **Figure 5** the 2021 WHO guidelines are substantially lower than current UK air quality standards and long-term air quality targets. Future air quality standards in the UK are likely to be more closely aligned with these guidelines, illustrating that continuous improvements in air quality will be required over the longer term to protect human health.

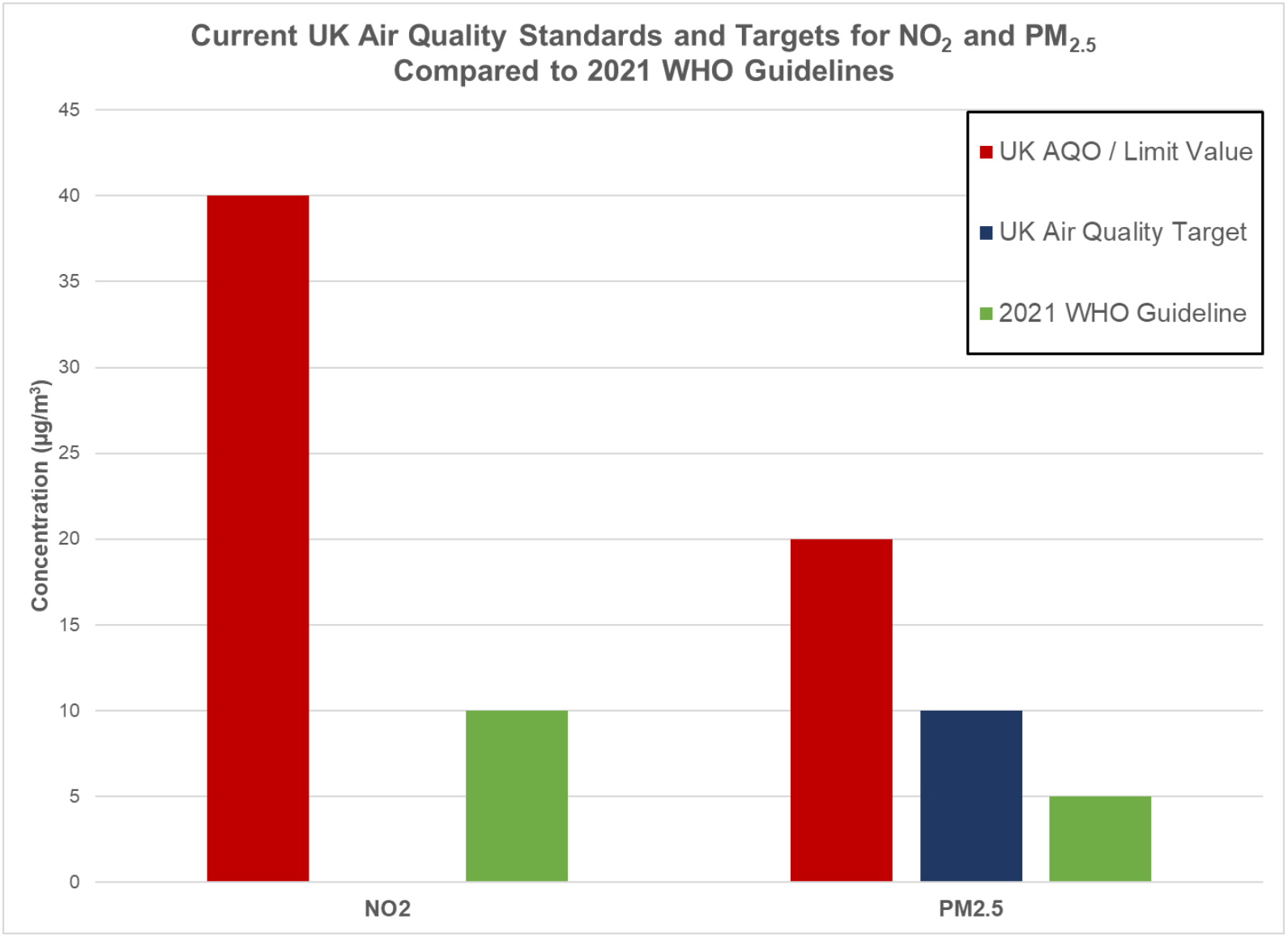

Figure 5 UK Air Quality Standards Compared to WHO Guidelines

Statutory nuisance

The Environmental Protection Act 1990[28] (EPA) provides for a statutory nuisance regime in England, Wales and Scotland. Categories of statutory nuisance include:

- Smoke emitted from premises so as to be prejudicial to health or a nuisance
- Fumes or gases emitted from premises so as to be prejudicial to health or a nuisance
- Any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance

Under section 79 of the EPA, a local authority must take "*such steps as are reasonably practicable*" to investigate a statutory nuisance complaint. Local authorities also have a duty to inspect their areas to detect whether a nuisance exists or is likely to occur or recur.

Smoke from private dwellings can constitute a statutory nuisance, provided that it is prejudicial to health or a nuisance.

Smoke control areas

Many parts of the UK are smoke control areas where:

- You cannot release smoke from a chimney
- You can only burn authorised fuel, unless you use an appliance approved by Defra (also known as an 'exempt appliance' or 'Defra approved appliance')

In England you may have to pay a penalty of up to £300 if your chimney releases smoke in a smoke control area and can be fined up to £1,000 if you buy unauthorised fuel to use in an appliance that's not approved by Defra.

In Essex, areas of Basildon, Brentwood and Thurrock have been declared as smoke control areas (https://uk-air.defra.gov.uk/data/sca/).

The Air Quality Strategy for England[3] states:

- Local authorities should keep the boundaries of existing Smoke Control Areas under review, especially if development has taken place outside of the boundaries. They should consider whether it would be beneficial to declare a new Smoke Control Area
- Local authorities with Smoke Control Areas are expected to enforce restrictions which apply within those areas
- All local authorities should enforce solid fuels regulations by ensuring that fuel being sold for domestic purposes has the "Ready to Burn" logo. Local authorities should ensure that no retailers are selling coal for indoor domestic burning from 1 May 2023

Environmental Permitting

Under the Environmental Permitting (England and Wales) Regulations 2016[29], local authorities must regulate certain types of industrial processes and other activities such as dry cleaners. This is to reduce any pollution they may cause and, in particular, to help improve air quality.

Listed activities include:

- Energy - burning fuel, gasification, liquefaction and refining activities
- Metals - manufacturing and processing metals
- Minerals - manufacturing lime, cement, ceramics or glass
- Chemicals - manufacturing chemicals, pharmaceuticals or explosives, storing chemicals in bulk
- Waste - incinerating waste, operating landfills, recovering waste
- Solvents - using solvents
- Other - manufacturing paper, pulp and board, treating timber products, coating, treating textiles and printing, manufacturing new tyres, intensive pig and poultry farming

Permits are issued by the Environment Agency or relevant local authority (the regulator)

depending upon the category of business and type of activity.

The operator of one of these installations must apply for a permit. If the authority decides to issue a permit, it must include conditions, which will say how pollution is to be minimised. Once a permit is issued, the operator must comply with the permit conditions.

Local authorities have powers if a business does not comply with its permit or operates without one. They can serve various sorts of legal notice and can also take the business to Court.

National policy

The Air Quality Strategy for England[3] sets out the actions that Defra expects local authorities to take in support of long-term air quality goals, including the recently introduced $PM_{2.5}$ targets.

All local authorities in England, including upper tier authorities (such as ECC), must have regard to the Air Quality Strategy for England[3]. This reflects the fact that where there are two tier authorities, county councils are expected to develop and implement measures to support district council air quality plans and strategies.

The Air Quality Strategy for England[3] also makes clear that:

- All local authorities are expected to support the delivery of national $PM_{2.5}$ targets by taking action to reduce emissions from sources within their control
- Local authorities should consider rolling out traffic management schemes using existing powers to improve air quality, whilst taking into account the views of local residents and businesses
- Local authorities should promote the use of cleaner non-road mobile machinery as part of construction and environment management plans for development they grant planning permission for and consider incentivising cleaner construction equipment through tendering processes

Local policy

Given the substantial influence emissions from road transport have on air pollution (particularly for nitrogen dioxide (NO_2)), local and regional transport and development strategies also have the potential to substantially influence air quality in Essex. Therefore, those plans and strategies which seek to minimise traffic flows and encourage the use of public transport and active modes of travel will also benefit local air quality.

One of the key outcomes of the current Essex Transport Strategy[30] is to "*… improve air quality through lifestyle changes, innovation and technology*". One of the identified 'challenges' in meeting this outcome is "*reducing pollution from transport to improve air quality in urban areas and along key corridors*". ECC are in the process of developing a new fourth Local Transport Plan, LTP4, which will replace the current Essex Transport Strategy in 2025. Air quality will be considered within LTP4, in line with guidance published by the government.

The Southend Local Transport Plan 3 Strategy Document[31], covers the period 2011-2026, and is supported by an Implementation Plan[32] within which Policy 12 is to "Maintain Air Quality". The current Thurrock Council Transport Strategy[33] also includes several measures aimed at "*Improving Air Quality and Addressing Climate Change*". These plans and strategies are also both currently in the process of being updated.

Local Plans, in particular, play an important role in the planning and delivery of sustainable development across Essex and can positively influence air quality by, for example, reducing the need for users or residents of new development to travel by car. This is recognised within the National Planning Policy Framework[34], which requires that policies should contribute towards achieving air quality standards and that opportunities to improve air quality or mitigate impacts should be identified.

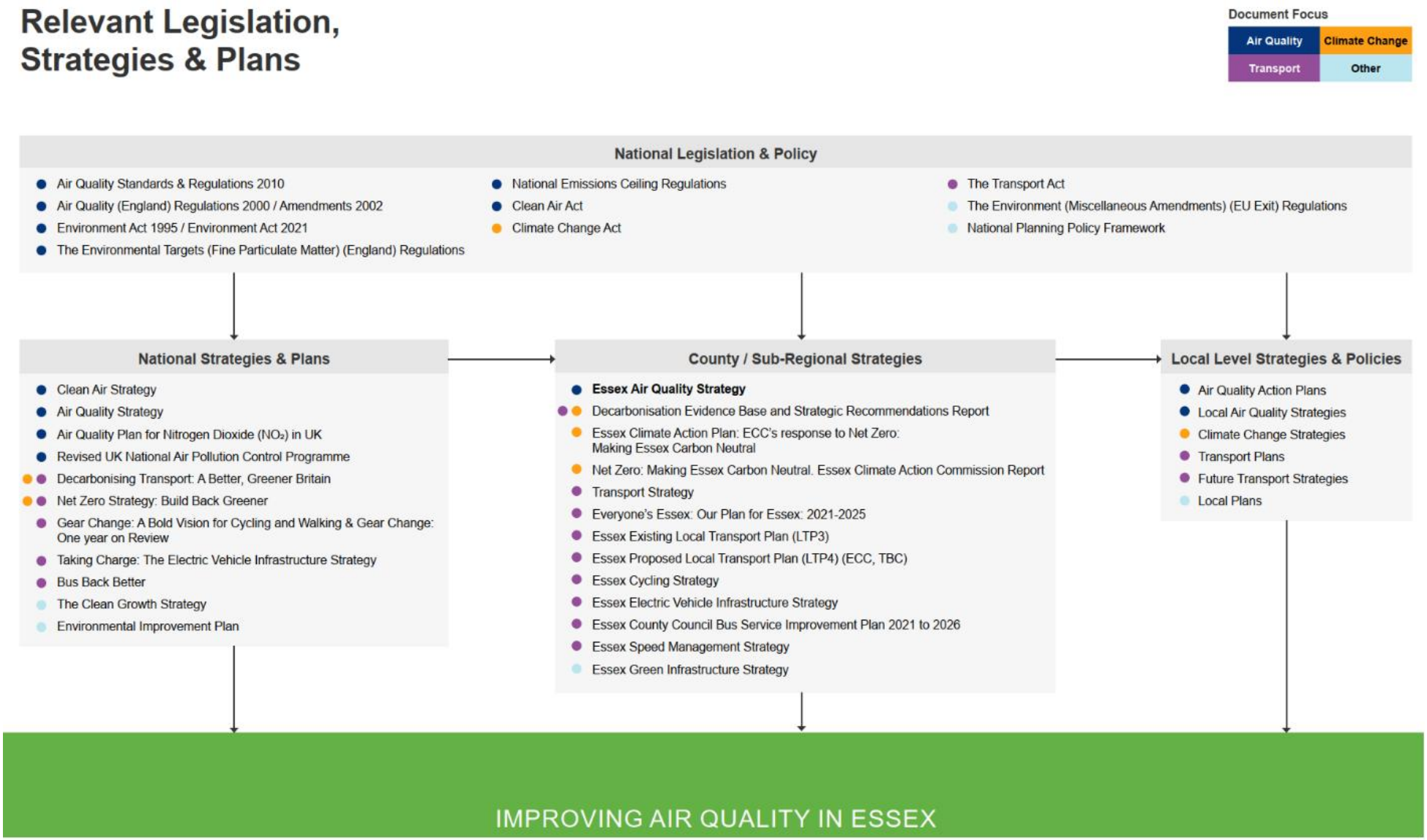

Figure 6 Legislation, policy and strategies influencing air quality in Essex

Current situation

Air quality hotspots

Approach

To understand current air quality issues in Essex, Local Air Quality Management reports and air quality monitoring data published by each of the relevant district / borough / city councils in Essex have been collated and reviewed. This information has been used to highlight key air quality hotspots in Essex where additional action is considered necessary to improve air quality. We have used the criteria set out in **Table 3** to rank the priority of the air quality issues identified in each district / borough / city council and unitary authority in Essex. This ranking is based on the legal requirement to meet air quality Limit Values in the shortest possible time, which is considered to be of the highest priority, and the level of measured air pollutant concentrations relative to relevant Air Quality Objectives in 2023.

Priority	Rationale
Very High	Exceedance of air quality Limit value
High	Exceedance of Air Quality Objective(s)
Medium	Concentrations close to but within Air Quality Objectives

Table 3 Criteria used to determine relative priority of air quality hotspots in Essex

Outcomes

The outcomes of this review are summarised in **Table 4** below, with all of the corresponding reports and monitoring data accessible via the Essex Air website (www.essexair.org.uk). A focus of the strategy is on those hotspots identified as being of 'very high' and 'high' priority, as these locations are where concentrations are highest and there is a legal requirement to improve air quality. Actions will, however, also be taken to improve air quality more generally across Essex and reduce overall exposure to pollution.

Further details of the air quality issues in each of the hotspots identified are provided in **Figure 7** to **Figure 9**.

Summary

In summary, and in order of priority:

- Very High priority - Exceedances of the annual mean NO_2 Limit Value have been identified adjacent to the A127 and East Mayne in Basildon
- High Priority - Exceedances of the annual mean NO_2 Air Quality Objective have been identified in Mersea Road in Colchester and Market Hill in Maldon
- Medium Priority – Annual mean NO_2 concentrations close to, but within the Air Quality Objective have been identified in Brook Street and Osborne Street / St John's Street in Colchester

Priority	Location	District / Borough / City / Unitary Authority	Annual Mean NO_2 Limit Value Exceedance in 2023? [a]	Exceedance of Annual Mean NO_2 Air Quality Objective in 2023? [b]
Very High	A127 and East Mayne	Basildon	**Yes**	No
High	Mersea Road	Colchester	No	**Yes**
High	Market Hill	Maldon	No	**Yes**
Medium	Brook Street	Colchester	No	No (2022 and 2023) **Yes** (2019, 2020 and 2021)
Medium	Osborne Street / St John's Street	Colchester	No	No (2020, 2022 and 2023) **Yes** (2019 and 2021)

[a] This means a legally binding air quality Limit Value is exceeded and action is required to achieve compliance in the shortest possible time.
[b] This means an Air Quality Objective is exceeded and district / borough / city councils are required to work towards achieving the Air Quality Objective, supported by ECC.

Table 4 Summary of air quality hotspots in Essex

Location:
A127 and East Mayne, Basildon

District / Borough / City:
Basildon Borough Council

Priority:
Very high

Key issue(s):
Exceedance of annual mean NO_2 air quality Limit Value along A127 and East Mayne

Key contributors:

- Locations of public access (e.g. footpaths) close to roads.
- A127 - High volumes of traffic travelling at high speed
- East Mayne – High volumes of traffic and congestion

Existing actions:

- Implementation of 50mph speed restriction along A127
- Changes to pedestrian route on East Mayne to minimise exposure
- Air quality and traffic sensors installed to understand causes of elevated pollutant concentrations

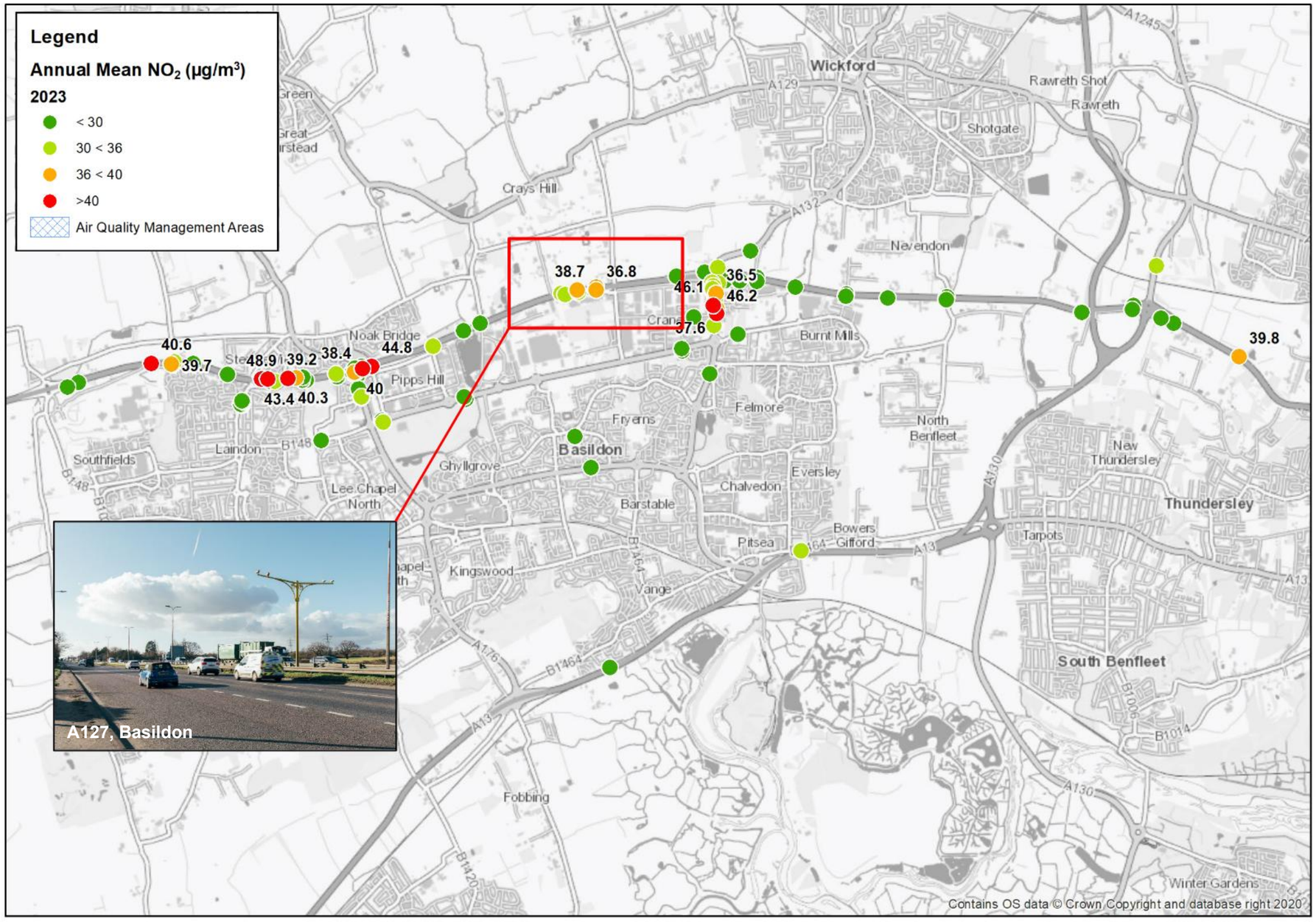

Figure 7 Air Quality Hotspot - A127 and East Mayne, Basildon

Location:
Central Colchester

District / Borough / City:
Colchester City Council

Priority:
High (Mersea Road)

Medium (Brook Street, Osborne Street and St John's Street)

Key issue(s):
Exceedance of annual mean NO_2 Air Quality Objective at residential properties along Osborne Street, Brook Street and Mersea Road

Key contributors:

- Properties very close to road
- Nearby buildings / walls on both sides of road act as 'street canyon' reducing dispersion and dilution of emissions
- Congestion during peak hours
- Uphill gradient and vehicle acceleration results in increased emissions (Mersea Road and Brook Street)
- High number of buses and idling buses associated with nearby Colchester bus station (Osborne Street)

Existing and proposed actions:

- Air Quality Action Plan being developed by Colchester City Council
- Air quality and traffic sensors installed to understand causes of elevated pollutant concentrations
- Feasibility and effectiveness of potential air quality interventions being investigated
- Colchester City Centre Masterplan and St Botolphs 'Levelling Up Fund' scheme both seek to encourage the use of non motorised modes within the city centre

Figure 8 Air Quality Hotspot - Central Colchester

Location: Market Hill, Maldon

Priority: High

Key issue(s):

Exceedance of annual mean NO_2 Air Quality Objective at residential properties along Market Hill

Key contributors:

- Residential properties very close to road
- Steep uphill road gradient (southbound) results in increased emissions
- Nearby buildings close to road act as 'street canyon' reducing dispersion and dilution of emissions

Existing actions:

- Air Quality Action Plan developed by Maldon District Council
- Feasibility and likely effectiveness of potential air quality interventions being investigated

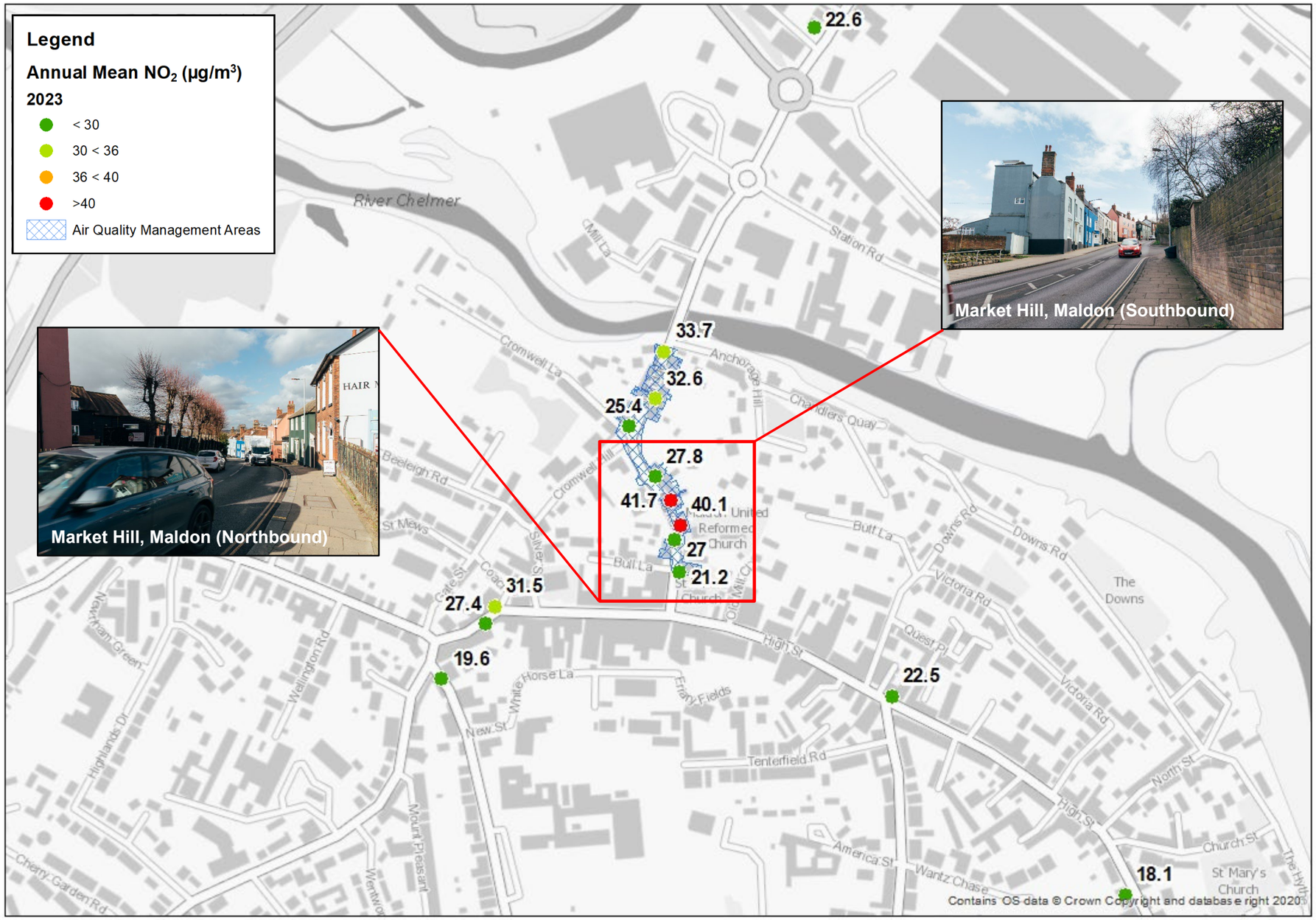

Figure 9 Air Quality Hotspot - Market Hill, Maldon

Particulate matter

As in most other parts of the UK, there are relatively few PM_{10} and $PM_{2.5}$ monitoring sites in Essex. This is because, historically, Air Quality Objectives for these pollutants have been met across the majority of the UK and such monitoring sites are difficult to implement and expensive to own and operate.

Measured annual mean concentrations of PM_{10} and $PM_{2.5}$ at monitoring sites in Essex between 2019 and 2023 are shown in **Table 5**.

These results suggest that the annual mean Air Quality Objectives / Limit Values for PM_{10} and $PM_{2.5}$ are met in Essex.

It is recognised, however, that, subject to funding, further monitoring is needed to more fully understand concentrations of particulate matter across Essex, particularly given the impact of this pollutant on human health.

Location	Pollutant	Air Quality Objective / Limit Value ($\mu g/m^3$)	Measured Annual Mean Concentration ($\mu g/m^3$)				
			2019	2020	2021	2022	2023
Springfield Road, Chelmsford	PM_{10}	40	25.3	21.9	24.7	19.3	20.6
Rainsford Lane, Chelmsford			18.7	21.4	24.0	25.0	23.5
London Road, Saffron Walden			24.7	27.1	28.1	30.9	28.7
Chalkwell Park, Southend			-	13.0	14.0	13.8	12.0
Grays, Thurrock			20.5	18.6	17.1	16.7	13.3
London Road, Purfleet			23.2	23.5	22.1	19.1	23.5
Manorway, Stanford-le-Hope			17.4	16.7	16.8	17.1	15.4
Chignal St James	$PM_{2.5}$	20	-	-	-	-	10.5
Springfield Road, Chelmsford			11.4	10.2	10.9	10.5	9.0
London Road, Saffron Walden			13.8	15.1	14.4	17.2	-
Chalkwell Park, Southend			11.0	8.0	9.0	8.8	7.8
Grays, Thurrock			-	-	-	-	8.1
Manorway, Stanford-le-Hope			11.6	11.6	11.9	11.9	9.5
Dock Road, Tilbury			-	-	10.8	11.2	10.3

Table 5 Measured Annual Mean Particulate Matter Concentrations in Essex (2019 – 2023)

.

How is air quality in Essex changing?

Observed trends

Nitrogen dioxide (NO_2)

Observed changes in roadside NO_2 concentrations in Essex are illustrated in **Figure 10**. The graphs show smoothed trends in measured NO_2 concentrations at roadside continuous monitoring sites in Chelmsford, Colchester and Thurrock between 2016 and 2023. They indicate there appears to have been a general reduction in annual mean NO_2 concentrations at roadside monitoring locations in Essex over this period - a trend which has also been observed in most other parts of the UK.

While lower concentrations in 2020 (and to a lesser extent 2021) were due in part to reductions in traffic volumes because of the COVID-19 pandemic (see **Figure 12**), observed reductions between 2016 and 2023 are also thought to have been associated with the introduction of more stringent NO_X emission standards (termed Euro standards) for new cars and vans from 2015 onwards and new lorries and buses from 2013 onwards.

The observed rate of improvement at these sites is, however, gradual (approximately 1 µg/m^3 per year).

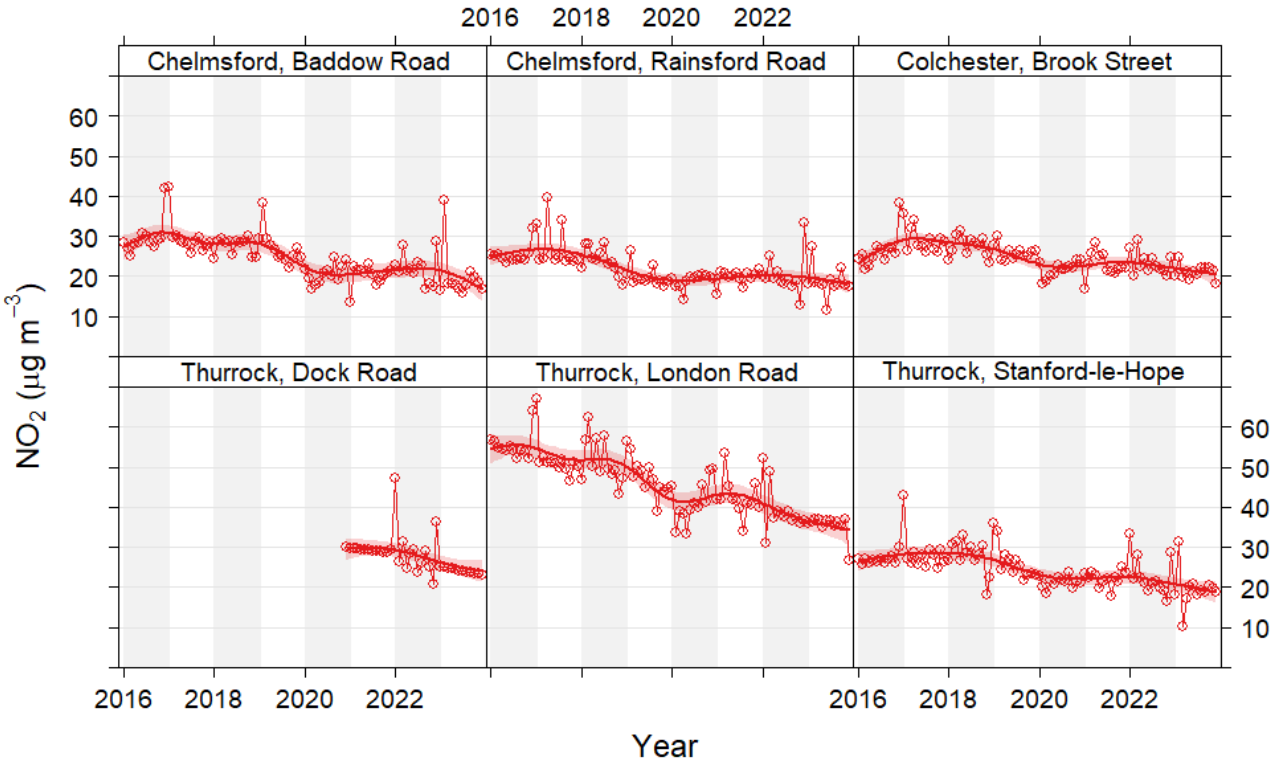

Figure 10 Observed Trends in NO_2 Concentrations at Roadside Continuous Monitoring Sites in Essex

Figure 11 shows average annual mean NO_2 concentrations across all kerbside[b], roadside[c] and urban background[d] monitoring sites within Essex between 2016 and 2023, which indicates a decreasing trend in NO_2 concentrations across Essex over this period, both at the roadside and in wider urban areas.

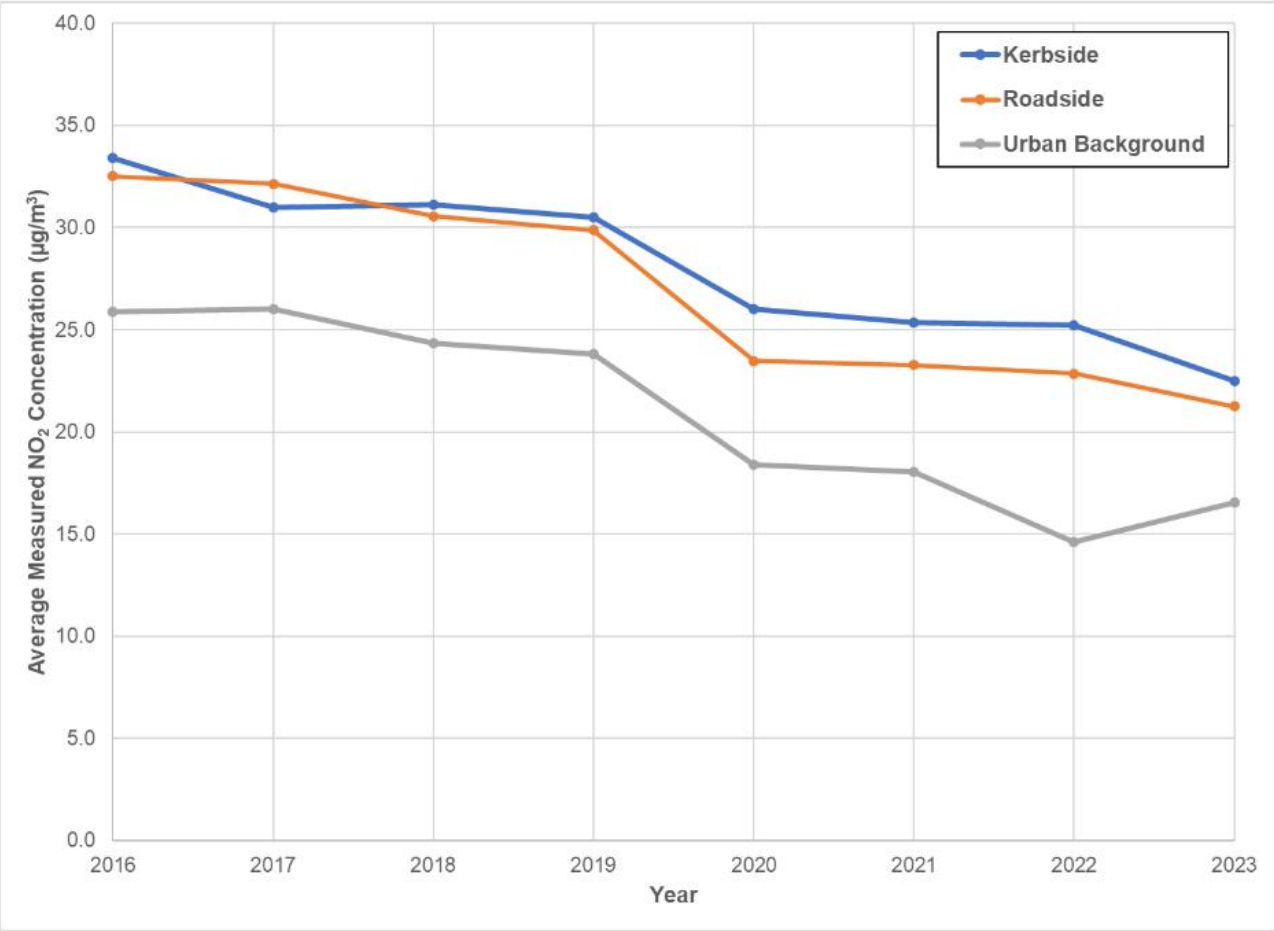

Figure 11 Trends in Average Annual Mean NO_2 Concentrations at Monitoring Sites in Essex

[b] A site sampling within one metre of the kerb of a busy road.

[c] A site sampling typically within one to five metres of the kerb of a busy road (although distance can be up to 15 m from the kerb in some cases).

[d] An urban location distanced from sources and therefore broadly representative of city-wide background conditions, e.g. urban residential areas.

Traffic flows

To understand observed trends in traffic flows in recent years within Essex, and the potential impact on road traffic emissions, Annual Average Hourly Traffic (AAHT) flows across urban traffic count sites have been collated and averaged. **Figure 12** indicates that traffic flows in 2020, and to a lesser extent 2021, were substantially lower on average than in 2019.

The influence of COVID-19 travel restrictions on traffic flows in 2020 and early 2021 can clearly be seen on the month graph (e.g. during March 2020 to June 2020 and November 2020 to February 2021). However, it appears that traffic flows in 2022 returned broadly to the levels observed in 2019. Morning and evening peak hour traffic flows on Mondays and Fridays in 2022 are, however, potentially slightly lower than in 2019, which perhaps reflects the influence of increased home working on these days.

While traffic flows in 2022 appear to have returned to those in 2019, NO_2 concentrations do not appear to have done the same, suggesting NO_X emissions per vehicle have decreased over this time period. As noted previously, this is thought most likely to be due to improvements in the vehicle fleet.

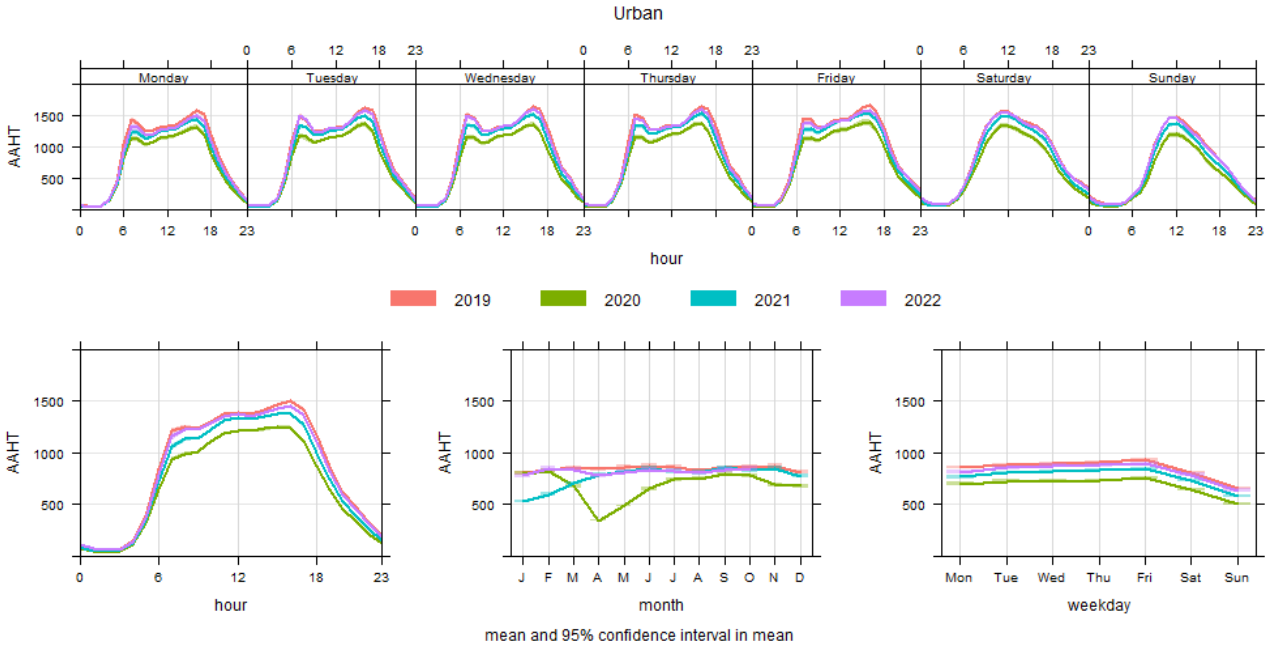

Figure 12 Observed trends in traffic flows at urban traffic count sites in Essex

Particulate matter

Observed changes in concentrations of particulate matter less than 10µm in diameter (PM_{10}) in Essex are illustrated in **Figure 13**. This shows smoothed trends in measured PM_{10} concentrations at continuous monitoring sites at roadside and urban background locations in Chelmsford and Thurrock (which are representative of PM_{10} concentrations in urban areas) and at a background site in Chignal St James (which is representative of PM_{10} concentrations across the wider area). This suggests there is no consistent trend in PM_{10} concentrations in Essex between 2016 and 2023.

One of the reasons observed trends in PM_{10} concentrations are substantially different to those for NO_2, is that PM_{10} concentrations are much less heavily influenced by emissions from road traffic exhaust emissions, which appear to have reduced over this period. Instead, they are more heavily influenced by emissions from other sources, e.g. domestic combustion and industry, and to a lesser extent by non-exhaust emissions from road traffic e.g. brake and tyre wear.

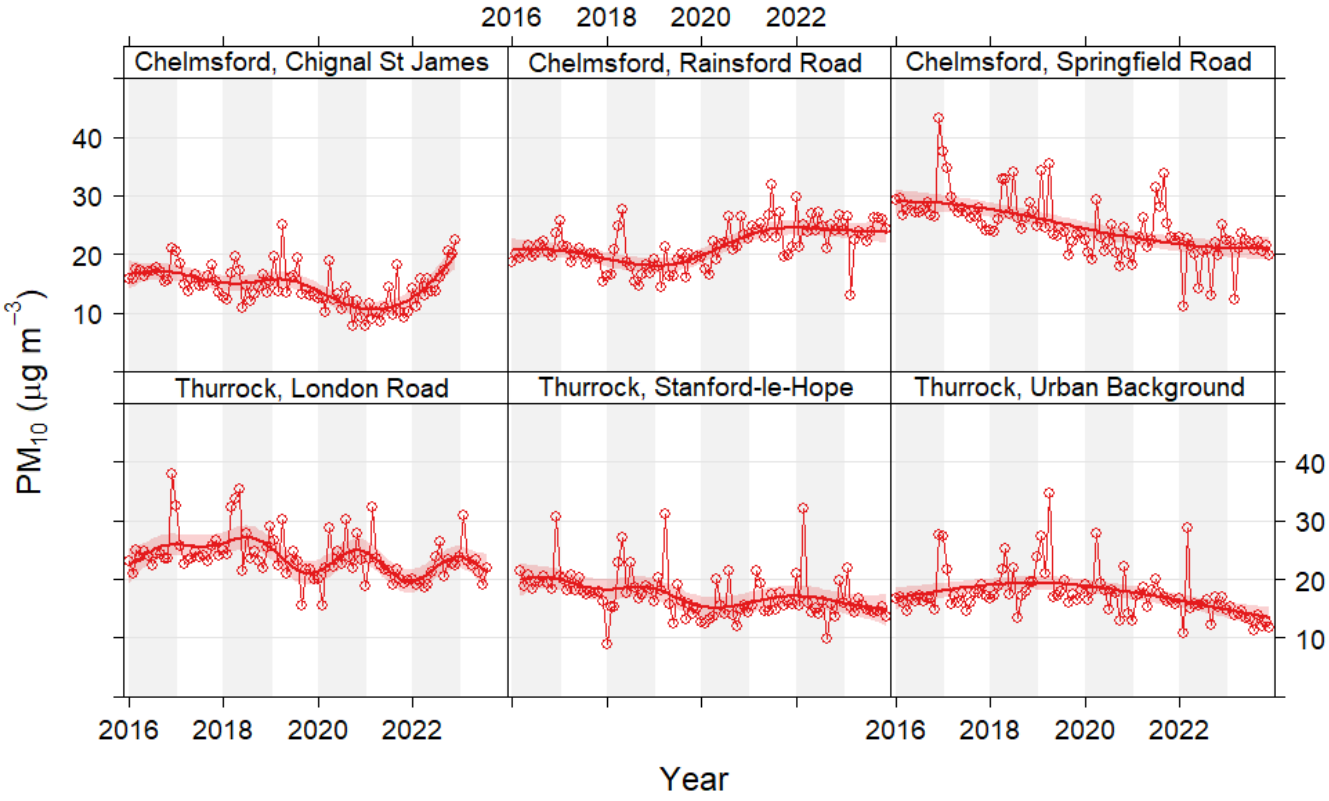

Figure 13 Observed trends in PM_{10} concentrations at monitoring sites in Essex

Future trends

Planned schemes and developments

It is recognised that there are a large number of planned schemes and developments which have the potential to affect road traffic and other sources of emissions (both positively and negatively) across Essex in future years.

More general trends, which are expected to occur in Essex, are discussed in the following sections.

Nitrogen dioxide

As more older vehicles are gradually replaced with newer vehicles with lower NO_X emissions, it is assumed that, in line with observed trends, NO_2 concentrations within Essex will continue to reduce gradually over time. The scale and rate of this reduction will depend on: changes in traffic flows over the same period; any changes in the effectiveness of the emissions reduction equipment fitted to newer vehicles and engine deterioration as they age; the rate at which older vehicles are replaced with newer vehicles; and the types of new vehicles that are taken up.

For example, electric vehicles have zero NO_X exhaust emissions, meaning that as more and more of these vehicles enter the national vehicle fleet, NO_2 concentrations will likely reduce further. While it is clear there are increasing numbers of electric cars and LGVs on the road, as yet HGVs and buses remain largely diesel powered and are likely to be so for some time into the future.

The gradual phase out of fossil-fuel fired boilers and their replacement with low carbon options such as ground or air source heat pumps will also reduce building related NO_X emissions in urban areas of Essex over time.

However, while overall improvements in NO_2 concentrations are expected to occur over time, primarily due to improvements in the national vehicle fleet, the scale and rate of this improvement is likely to be influenced by economic factors and practical issues, e.g. production times and volumes of electric vehicles, and the availability of charging infrastructure, and will vary by geographical area. Additional local action is therefore likely to be required to improve air quality more rapidly in some areas than might otherwise happen gradually over time.

Future traffic flows

National projections[35] recognise there is considerable uncertainty around future travel demand, including the extent to which social and behavioural change, emerging technologies, decarbonisation, active and sustainable travel, demographic change and growth in the economy will influence how, when where, and if, we travel. The projections suggest traffic flows will increase over time, but that a wide range of traffic growth is possible in the long term, with the scenarios considered suggesting an 8% to 54% increase in distance driven between 2025 and 2060.

Particulate matter

It is anticipated that there will be an overall reduction in emissions of $PM_{2.5}$ within towns and cities over time. This will occur partially as a result of decline in tailpipe emissions of $PM_{2.5}$ as older and poorer performing vehicles leave the fleet to be replaced by cleaner or fully electrified vehicles. However, battery electric vehicles (EVs) are not 'zero emission' and will continue to emit $PM_{2.5}$ (and PM_{10}) from road and tyre wear and from braking.

The Air Quality Expert Group[12] suggests that as regenerative braking, which is typically used in electric and hybrid vehicles, does not rely on frictional wear of brake materials, such vehicles should have lower brake wear emissions. However, tyre and road wear emissions increase with vehicle mass, which means electric and hybrid vehicles, which are typically heavier due to the weight of batteries, are likely to have higher emissions of PM. The net balance between these two factors is not currently known and will depend upon road type and driving mode. In locations where brake wear makes a major contribution to overall non-exhaust emissions (e.g. in urban areas where braking happens more frequently), it seems likely that there will be a net benefit, but this has yet to be demonstrated.

In addition, while further increases in domestic woodburning could result in increased $PM_{2.5}$ emissions in the short-term, it is thought reductions in $PM_{2.5}$ emissions in urban areas will arise over the longer term. This is due to

action being taken at a national level on solid fuel burning and stove appliances, enhanced controls on tailpipe emissions from off-road construction vehicles, plant and the wider construction sector, and also from improved abatement from backup electrical generators. Actions taken at a regional and local level also have the potential to reduce $PM_{2.5}$ emissions in urban areas, where exposure to pollution is greatest.

With such measures, outdoor concentrations of $PM_{2.5}$ are anticipated to reduce in the coming years. Such improvements may be relatively small, however, as many of the largest and most readily abated sources have already been addressed. Furthermore, $PM_{2.5}$ concentrations are heavily influenced by emissions from the rest of the UK, outside of the UK and natural sources, which are unlikely to reduce to the same extent (see **Figure 14**).

However, even with the forecast improvements in $PM_{2.5}$ concentrations over time shown in **Figure 14**, concentrations of $PM_{2.5}$ are still estimated to be well in excess of the 2021 WHO Guideline (i.e. 5 $\mu g/m^3$) and there is no known safe level for this pollutant.

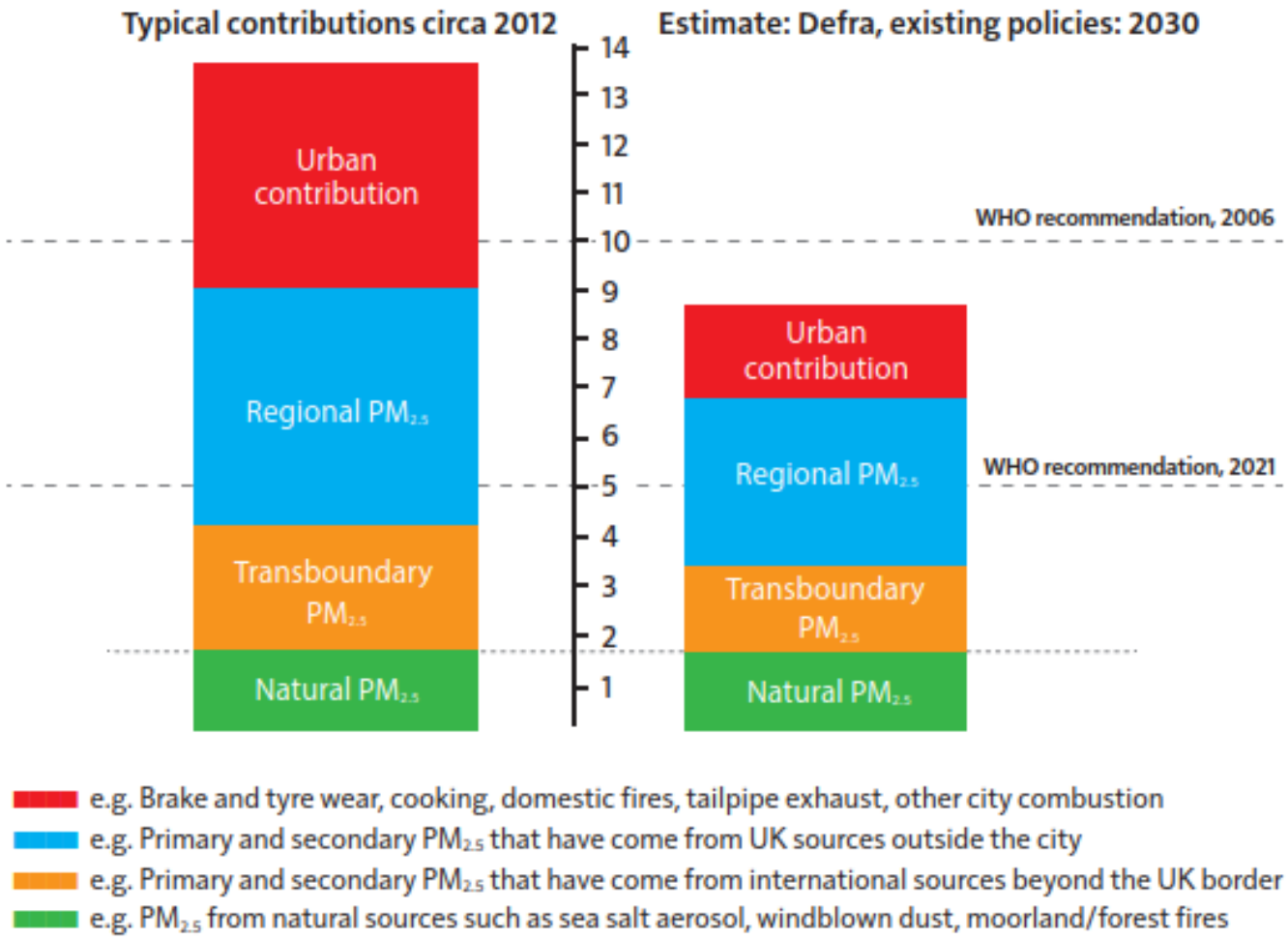

Figure 14 A qualitative representation of the different contributing sources to $PM_{2.5}$ that might be experienced in a typical urban centre (England)

SOURCE: Chief Medical Officer's Annual Report 2022[36]

Opportunities to improve air quality

Which emission sources can we influence directly?

As the highway authorities for non-motorway and trunk roads in Essex, ECC, Southend Council and Thurrock Council have the ability to influence road traffic emissions in Essex (e.g. by implementing measures to improve the local vehicle fleet or to further encourage the use of public transport, cycling and walking).

ECC (as a county council) and Southend-on-Sea City Council and Thurrock Council (as unitary authorities), also have some direct influence over emissions from:

- combustion in some institutional buildings (such as schools and council owned buildings)
- equipment used on our construction projects (e.g. through procurement contracts)
- waste treatment and disposal

As local planning authorities, each of the district, borough and city councils and unitary authorities (i.e. Thurrock Council and Southend Council) can implement planning policy to reduce or limit the impact of new development on air quality.

District, borough and city councils and unitary authorities (i.e. Thurrock Council and Southend Council) are also able to influence emissions from some smaller energy generation or industrial sources through local permitting processes.

We have little direct influence, however, over emissions associated with energy generation or industry, as larger such sources are permitted at a national level by the Environment Agency.

Reducing emissions

The most effective and reliable way to improve air quality is to reduce emissions at source. By doing so, this will often result in other benefits. e.g. reduced emissions of greenhouse gases.

There are several broad opportunities available to reduce emissions with the aim of improving air quality. Each of these opportunities are briefly discussed below.

In **Table 6** the likely size of the potential benefit of each opportunity on emissions of nitrogen oxides (NO_X), fine particulate matter ($PM_{2.5}$) and greenhouse gases (GHGs) is summarised.

The likely size of the potential emissions benefits has been assessed qualitatively on a 3-point scale suing professional judgement, with:

- "↓↓↓" representing a large benefit
- "↓↓" representing a moderate benefit
- "↓" representing a small benefit
- "**-**" a neutral/negligible impact

Opportunities to reduce emissions	Potential emissions benefit		
	NO_X	$PM_{2.5}$	GHGs
1. Reducing the volume of traffic / mode shift	↓↓↓	↓↓	↓↓
2. Improving the local vehicle fleet	↓↓(↓^{EV})	↓(-^{EV})	↓(↓^{EV})
3. Vehicle charging or access restrictions	↓↓↓	↓↓	↓↓
4. Education and encouraging behavioural change	↓	↓	↓
5. Improving the flow of traffic	↓	↓	↓
6. Reducing emissions from combustion in institutional buildings	↓	-	↓
7. Reducing combustion emissions from construction plant and machinery	↓	↓	-(↓^{EV})
8. Reducing emissions from waste treatment and disposal	-	↓	↓↓
9. Delivering new net zero carbon residential and non residential developments	↓	-	↓↓
Note: (EV) denotes the additional benefit associated with the use of Electric Vehicles			

Table 6 Summary of opportunities to reduce emissions

1. Reducing the volume of traffic / mode shift

Moving from private car use to walking, cycling, car-sharing, public transport or working from home can reduce the number of vehicles in use at any one time. The sustainable planning of new development (e.g. housing, employment, services) and its location can also reduce the need for car journeys and encourage the use of alternative modes of transport.

Such options will reduce emissions of oxides of nitrogen (NO_X), particulate matter (PM) and greenhouse gases, with the scale of the reduction achieved directly proportional to the reduction in traffic.

Increasing walking and cycling has the added benefit of increasing physical activity, which is associated with reductions in heart disease, stroke, diabetes and several cancers and can also improve mental health and wellbeing[37].

2. Improving the local vehicle fleet

Discouraging the most polluting vehicles and encouraging the uptake of newer, cleaner vehicles (both private, commercial and public) will lead to an overall reduction in air pollution (particularly NO_X).

As electric vehicles have zero NO_X exhaust emissions and are associated with lower greenhouse gas emissions than conventionally fuelled vehicles (at the tailpipe), actions taken to increase the proportion of electric vehicles in the fleet are likely to have the greatest impact on emissions (albeit the potential effect of such vehicles on $PM_{2.5}$ emissions is less certain due to emissions from brake and tyre wear).

3. Vehicle charging or access restrictions

Prohibiting, restricting or charging vehicles to access, pass through or park in a particular area (e.g. through the use of Clean Air Zones, Workplace Parking Levies or congestion charging) has the potential to benefit air quality by reducing traffic volumes and / or improving the local vehicle fleet in the area in question.

However, as suitable alternative routes and high levels of public transport provision are required (so that affected vehicle owners can choose to avoid such zones or travel by a different mode of transport), such interventions are considered more suitable for larger, metropolitan areas, rather than smaller towns and cities. Furthermore, such schemes typically have high implementation and back-office costs.

It is also recognised that such schemes can impose significant additional costs on individuals, businesses or organisations, and that such costs are more likely to be incurred by those who are less able to afford them (e.g. those who own or operate an older vehicle and cannot afford to buy a newer one).

4. Education and encouraging behavioural change

Increasing and improving awareness about air pollution and subsequently encouraging behavioural change to improve air quality (within businesses, organisations, local communities and the council) could result in reductions in emissions from a wide range of sources across Essex, albeit the effects at any particular location may be relatively small.

This could, for example, include actions to reduce vehicles idling (e.g. outside schools) or trying to reduce emissions from domestic combustion by providing advice on approved appliances and the types of fuel which should be used, or highlighting the air quality benefits of replacing fossil fuel-fired boilers with heat pumps.

5. Improving the flow of traffic

Reducing traffic volumes and associated congestion (e.g. through modal shift and behavioural change) and encouraging smoother and faster journeys will help reduce NO_X emissions, which are typically increased during stop-start driving conditions. Reductions in emissions of $PM_{2.5}$ and greenhouse gases would also be expected due to reduced fuel consumption.

However, reduced congestion at a particular location could encourage additional traffic movements, resulting in increased emissions elsewhere.

6. Reducing emissions from combustion in institutional buildings

Reducing the combustion of fossil fuels to provide heating and / or electricity within

institutional buildings such as schools will result in a reduction of NO_X and greenhouse gas emissions. Such measures are, however, unlikely to have a substantial effect on emissions of $PM_{2.5}$ as it is assumed the majority of such combustion sources are gas-fired, which result in negligible $PM_{2.5}$ emissions.

7. Reducing combustion emissions from construction plant and machinery

Non-road mobile machinery (NRMM), such as construction equipment, can be a significant source of pollution in local areas. Similar to road vehicles, NRMM are subject to emission standards, with increasingly stringent standards applied over time. These are known as emission stages, the most recent of which is 'Stage V'.

Using NRMM which meets the latest emission stages will result in lower NO_X and $PM_{2.5}$ emissions, whilst using zero-emission NRMM (e.g. electrically powered) will also result in reduced greenhouse gas emissions.

8. Reducing emissions from waste treatment and disposal

Reducing the volume of waste created and maximising reuse and recycling will reduce $PM_{2.5}$ and greenhouse gas emissions associated with waste treatment and disposal.

9. Delivering new net zero carbon residential and non residential developments

Delivering new developments which are net zero carbon in operation will not only reduce emissions of greenhouse gases but also NO_X and $PM_{2.5}$ emissions owing to the use of low carbon heat pumps etc. instead of gas or oil fired boilers.

Green infrastructure

Green infrastructure, such as trees, green walls and hedges, can capture PM on leaf surfaces, but is unlikely to influence NO_2 concentrations other than where it acts as a physical barrier[38].

The good placement and correct application of green infrastructure assets can, however, play an important role in reducing exposure to air pollution. Examples include the use of vegetation barriers between busy roads and sensitive receptors to block NO_2 and/or to capture particulate matter; or specific tree planting to force emissions upwards or generate turbulence, thereby aiding the dilution and dispersion of air pollutants.

It can be difficult to implement green infrastructure because of space constraints. In some cases, such as within street canyons, it could also make air quality worse by affecting air flow and inhibiting the dispersion and dilution of emissions.

However, when located and positioned correctly, green infrastructure can play an important role in protecting individuals from road traffic emissions and improving air quality by absorbing PM.

New schemes or developments at the design stage provide an ideal opportunity to incorporate multifunctional green infrastructure into the urban streetscape to benefit air quality and encourage the use of alternative modes of transport to the car. Green infrastructure assets can also be implemented to improve existing situations, where the public are at risk from elevated traffic emissions, e.g. within school playgrounds or on cycle paths and pavements.

Green infrastructure targeted at improving air quality has many other benefits, including:

- absorbing CO_2, therefore combatting climate change
- supporting biodiversity
- improving the look and feel of urban areas

Reducing exposure to pollution

While the preferred way to improve air quality is to reduce emissions at source, by reducing exposure to poor air quality we can decrease the likelihood of negative health impacts and damage to the environment.

This could be achieved by providing guidance to inform the design of new developments to protect future residents. Development can be avoided where direct or indirect emissions may cause a detrimental impact to sensitive human health or ecological receptors.

Mechanical ventilation and/or filtration could also be used to improve indoor air quality (e.g. within schools). For example, opportunities exist to improve indoor air quality within buildings when mechanical ventilation systems are installed as part of retrofit projects to install heat pumps.

Emerging technology (such as Roadvent[39]) could also be used to capture and treat road traffic emissions at source, which could be used to manage air quality in certain areas in the short-term.

Figure 15 Roadvent

Current activities

We are currently undertaking a number of activities, alongside district / borough / city councils in Essex, to improve air quality, some of which are outlined below.

Basildon

Due to exceedances of the annual mean nitrogen dioxide (NO_2) air quality Limit Value along the A127 and East Mayne in Basildon, we worked together with Basildon Borough Council to implement a number of measures aimed at reducing road traffic emissions and exposure to NO_2 in these locations including:

- A 50mph speed restriction along a stretch of the A127 to reduce road traffic oxides of nitrogen (NO_X) emissions (which are increased at higher speeds relative to 50mph). In addition, the speed restriction allowed for a transition to smoother driving behaviour tempering higher acceleration events which cause increased NO_X emissions.
- The relocation of the pedestrian/cyclist route on East Mayne to reduce exposure to elevated NO_2 concentrations
- Additional charging points for electric vehicles
- Cycle route improvements

Further details of these measures can be found at: https://www.essexhighways.org/highway-schemes-and-developments/highway-schemes/basildon-schemes/air-quality.

Monitoring is currently being undertaken to evaluate changes in air pollutant concentrations in these areas.

Colchester sensor project

Alongside Colchester City Council, we were successful in obtaining funding from the 2021/2022 Defra Air Quality Grant to purchase, install and operate a number of air quality and traffic sensors in central Colchester. Data collected from these sensors is currently being analysed to understand the causes of elevated pollutant concentrations in the central Colchester AQMA and inform the development of air quality interventions.

EssexAir website

In partnership with district / borough / city councils in Essex, we have developed an updated air quality website for Essex (www.essexair.org.uk). The aim of the website is to make air quality data and information more readily available to the public, raising awareness and encouraging people to make changes to help improve air quality in Essex.

Theatrical education for children

We arranged for an innovative theatrical educational programme to be delivered to primary school children in Essex. The aim was to improve pupil's understanding of air quality and encourage them and their families to consider how they could help improve air quality, e.g. increased walking and cycling.

To date, the programme has been delivered to approximately 100 schools in Essex, reaching over 5,000 pupils.

Figure 16 Example of feedback

Air quality monitoring near schools

We have undertaken air quality monitoring along roads close to a number of primary schools in Essex, using both diffusion tubes and backpack-mounted air quality sensors. Once complete, this information will be shared with these schools, and on the updated Essex Air website, to raise awareness of air pollutant concentrations local to each school and encourage children, parents and staff to make positive changes to improve air quality.

Figure 17 Backpack monitoring

Future transport strategies

In collaboration with the relevant local authorities, we have prepared a range of local transport strategy documents, which will be integrated within LTP4. Future Transport Strategies have been prepared for Chelmsford and Colchester urban areas setting out current issues (including air quality) and the approach to how they can be addressed.
These strategies will provide the framework enabling potential transport schemes to be identified and prioritised. Similar strategies have also been prepared for Braintree urban area and Maldon District.

District / borough / city councils and unitary authorities

Each of the district / borough / councils and unitary authorities in Essex which have declared an Air Quality Management Area (AQMA) have produced an Air Quality Action Plan (AQAP) or have developed an air quality strategy, which sets out local measures aimed at improving air quality in these areas. These AQAPs / strategies are summarised in **Table 7**.

District / Borough / City	Current AQAPs / Strategy	New AQAP / Strategy in development?
Brentwood	Brentwood Borough Council Air Quality Action Plan (2008)	All AQMAs are proposed to be revoked therefore consideration being given to development on an Air Quality Strategy going forwards
Colchester	Colchester Air Quality Action Plan 2016-2021	Yes, an updated AQAP is in the process of being developed
Chelmsford	Chelmsford Air Quality Strategy (2022)	Not applicable (air quality strategy still current)
Epping Forest	Air Quality Action Plan Epping Forest District Council (2023-2028)	Not applicable (AQAP still current)
Maldon	Air Quality Action Plan 2020 - 2025	Not applicable (AQAP still current)
Rochford	Rayleigh Town Centre Air Quality Action Plan Report (2017)	All AQMAs are proposed to be revoked therefore consideration being given to development on an Air Quality Strategy going forwards
Thurrock	Thurrock Air Quality and Health Strategy (2016)	Yes, an updated strategy is in the process of being developed
Southend-on-Sea	AQMA1 – Air Quality Action Plan 2017 AQMA2 - Air Quality Action Plan 2023 – 2027	Yes, an updated AQAP is in the process of being developed Not applicable (AQAP still current)

Table 7 Summary of Air Quality Action Plans / Strategies in Essex

Other air quality projects undertaken by district / borough / city councils and unitary authorities in Essex have mainly focussed on raising awareness of air quality and promoting positive behavioural change. Some recent examples include:

- The Saffron Walden Clean Air project (Saffron Walden Clean Air Project - Uttlesford District Council), which will pilot green modes of transport and encourage active travel in the town, with the long-term aim of reducing car use for short in-town journeys.
- The Colchester CAReless project (CAReless - Colchester City Council), which encourages drivers to switch off their engines when stationary to help improve air quality in the town and to reduce the amount of polluted air that people breathe inside their cars.
- The Colchester Home Burning Campaign (Home Burning Campaign - Colchester City Council), which aimed to raise awareness of the health impacts of pollution generated by home fires and log burners and help local 'burners' take positive action to reduce these risks and 'burn safe', 'burn better', 'burn clean' and 'burn less'.
- The Southend-on-Sea Cough, Cough, Engine Off campaign (Anti-idling – Air quality – Southend-on-Sea City Council), which encourages drivers to switch off their engines when parked up and waiting. It draws attention to the health risks of continued idling and aims to reduce the numbers of idling vehicles in Southend-on-Sea.
- Southend-on-Sea's Clean Air for School's Project (Clean air for schools project – Air quality – Southend-on-Sea City Council), which focuses on schools in Southend-on-Sea that sit along the A13 and A127 or within AQMAs. Air quality monitoring devices were installed at the schools to determine $PM_{2.5}$ and NO_2 levels (which can be viewed here). School air quality audits and assessments of specific school activities and interventions were undertaken. Further engagement was also undertaken with the schools on actions, intervention options and campaigns on air quality, reducing pollution exposure, and how to achieve safer, more active travel and modal shift. The project also includes funding for interventions, activities, and local campaigns for schools.

The provision of electric vehicle charging provision continues to increase across each of the district / borough / city councils and unitary authorities, both for public, council fleet and staff use. Council office buildings are reducing capacity for staff at offices, enabling staff a greater flexibility to work from home, whilst encouraging the use of car share schemes when travel to an office is required.

Each district / borough / city councils continues to work in partnership with ECC to deliver major transport improvement schemes aimed at alleviating congestion. For example, the proposed expansion of Chelmer Valley and Sandon Park and Ride services will increase overall Park and Ride spaces in Chelmsford and reduce traffic heading into the city centre and using the Army and Navy AQMA junction. Alongside Essex Highways, new Future Transport Strategies being developed for the district / borough / city councils will consider an objective to work towards reducing air pollution where poor air quality exists, strengthening ties between transport schemes and air quality.

Glossary

Term	Description
Air Quality Action Plan (AQAP)	A plan setting out the actions that will be taken at a local level to improve air quality within an air quality management area.
Air quality Limit Value	Legally binding limits for concentrations in outdoor air of major air pollutants that impact public health. The Secretary of State for Environment, Food and Rural Affairs has responsibility for meeting the Limit Values in England and the Department for Environment, Food and Rural Affairs (Defra) co-ordinates assessment and air quality plans for the UK as a whole.
Air Quality Management Area (AQMA)	Local authorities in the UK are required to review air quality in their area and designate air quality management areas in those areas where Air Quality Objectives are exceeded.
Air Quality Objective	An air quality standard, which if exceeded, district, borough and city councils are required to work towards achieving.
Air Quality Target	A long-term air quality standard for particulate matter which the UK Government is required to achieve by the end of 2040.
CO_2	Carbon dioxide, a greenhouse gas.
Defra	Department for Environment, Food and Rural Affairs.
ECC	Essex County Council.
KPI	Key Performance Indicator.
Local Air Quality Management (LAQM)	The process by which air quality is assessed and managed at a local level, as defined in the Environment Act 1995, Environment Act 2021 and supporting policy and technical guidance.
NO_2	Nitrogen dioxide.
NO_x	Nitrogen oxides.
PM	Particulate Matter.
PM_{10}	Particulate matter less than 10 µm in diameter.
$PM_{2.5}$	Particulate matter less than 2.5 µm in diameter.

Term	Description
$PM_{0.1}$	Particulate matter less than 0.1 µm in diameter.
$\mu g/m^3$	Microgrammes (one-millionth of a gramme) per cubic meter air.
WHO	World Health Organization.

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