Chapter 5

Climatic factors

Policy context

International

5.1 United Nations Paris Climate Change Agreement (2015) **[See reference 105]**: International agreement to keep global temperature rise this century well below 2 degrees Celsius above pre-industrial levels.

5.2 The **2030 Agenda for Sustainable Development** (2015) **[See reference 106]**: This initiative, adopted by all United Nations Member States, provides a shared blueprint for peace and prosperity for people and the planet and includes 17 Sustainable Development Goals (SDGs), designed to achieve a better and more sustainable future for all. Relevant to this topic are:

- SGD 7: Affordable and Clean Energy.
- SDG 11: Sustainable Cities and Communities.
- SDG 12: Responsible Consumption and Production.
- SDG 13: Climate Action.
- SDG 14: Life Below Water.
- SDG 15: Life on Land.

National

5.3 The **NPPF** (2021) **[See reference 107]** contains as part of its environmental objective a requirement to mitigate and adapt to climate change, "including moving to a low carbon economy". The document also states that the "planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change." To achieve these aims new development should be planned to ensure appropriate adaptation measures are included (including green infrastructure) and should be designed, located and orientated as to help to reduce greenhouse gas emissions.

5.4 The revised framework also requires that development is directed away from areas which are at highest existing or future risk of flooding. Where development is required in such areas, the "development should be made safe for its lifetime without increasing flood risk elsewhere."

5.5 In relation to coastal change in England planning policies and decisions should take account of the UK Marine Policy Statement and marine plans. Furthermore, plans should "reduce risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating the impacts of physical changes to the coast".

5.6 The NPPF is supported by planning practice guidance relating to:

- **Flood risk and coastal change** (2021) **[See reference 108] -** Provides guidance on how the planning process can assess, avoid, manage and mitigate the risks associated with flooding and coastal change.
- **Climate change** (2019) **[See reference 109] -** Advises how to identify suitable mitigation and adaptation measures in the planning process to address the impacts of climate change.
- **Renewable and low carbon energy** (2015) **[See reference 110] -** Outlines guidance for developing a strategy for renewable and low carbon energy, and particular planning considerations for hydropower, solar technology, solar farms and wind turbines.

5.7 The **Environment Act 2021** **[See reference 111]** sets statutory targets for the recovery of the natural world in four priority areas: air quality, biodiversity, water, and resource efficiency and waste reduction. The Environment Act will deliver:

- Long-term targets to improve air quality biodiversity, water, and waste reduction and resource efficiency.
- A target on ambient $PM_{2.5}$ concentrations.
- A target to halt the decline of nature by 2030.
- Environmental Improvement Plans, including interim targets.
- A cycle of environmental monitoring and reporting.
- Environmental Principles embedded in domestic policy making.
- Office for Environmental Protection to uphold environmental law.

5.8 The **Net Zero Strategy: Build Back Greener** (2021) **[See reference 112]** sets out policies and proposals for decarbonising all sectors of the UK economy to meet net zero targets by 2050. It sets out strategies to keep the UK on track with carbon budgets, outlines the National Determined Contribution (NDC) and sets out the vision for a decarbonised economy in 2050. Its focus includes:

- Policies and proposals for reducing emissions across the economy in key sectors (power, fuel supply and hydrogen, industry, heat and buildings, transport, natural gas and waste); and
- Policies and proposals for supporting transition across the economy through innovation, green investment, green jobs, embedding net-zero in government, local climate action, empowering people and businesses, and international leadership and collaboration.

5.9 The **Energy White Paper: Powering our net zero future** (2020) **[See reference** 113**]** builds on the Prime Minister's ten-point plan for a green industrial revolution. The white paper addresses the transformation of the UKs energy system, promoting high-skilled jobs and clean, resilient economic growth during its transition to net-zero emissions by 2050.

5.10 Key aims of the paper include:

- Transforming the energy system - To transform its electricity grid for net-zero, the white paper highlights how this will involve changing the way the country heats its homes, how people travel, doubling the electricity use, and harnessing renewable energy supplies.
- Generating emission-free electricity by 2050 - The government aims to have "overwhelmingly decarbonised power" in the 2030s in order to generate emission-free electricity by 2050.
- Investing in electric vehicle charge points - The government plans to invest £1.3bn to accelerate the rollout of charge points for electric vehicles as well as up to £1bn to support the electrification of cars, including for the mass-production of the batteries needed for electric vehicles.

5.11 Decarbonising Transport: A Better, Greener Britain (2021) **[See reference 114]** The Decarbonisation Transport Plan (DTP) sets out the Government's commitments and the actions needed to decarbonise the entire transport system in the UK. It follows on from the Decarbonising Transport: Setting the Challenge report published in 2020. The DTP commits the UK to phasing out the sale of new diesel and petrol heavy goods vehicles by 2040, subject to consultation, in addition to phasing out the sale of polluting cars and vans by 2035. The DPT also sets out how the government will improve public transport and increase support for active travel, as well as creating a net zero rail network by 2050, ensuring net zero domestic aviation emissions by 2040, and a transition to green shipping.

5.12 Decarbonising Transport: Setting the Challenge (2020) **[See reference 115]** sets out the strategic priorities for the new Transport Decarbonisation Plan (TDP), published in July 2021. It sets out in detail what government, business and society will need to do to deliver the significant emissions reduction needed across all modes of transport, putting us on a pathway to achieving carbon budgets and net zero emissions across every single mode of transport by 2050. This document acknowledges that while there have been recently published strategies to reduce greenhouse gas emissions in individual transport modes, transport as a whole sector needs to go further and more quickly, therefore the

TDP takes a coordinated, cross-modal approach to deliver the transport sector's contribution to both carbon budgets and net zero.

5.13 The Road to Zero (2018) **[See reference 116]**: Sets out new measures towards cleaner road transport, aiming to put the UK at the forefront of the design and manufacturing of zero emission vehicles. It explains how cleaner air, a better environment, zero emission vehicles and a strong, clean economy will be achieved. One of the main aims of the document is for all new cars and vans to be effectively zero emission by 2040.

5.14 Flood and Coastal Erosion Risk Management: Policy Statement (2020) **[See reference 117]**: This policy statement sets out the government's long-term ambition to create a nation more resilient to future flood and coastal erosion risk, and in doing so, reduce the risk of harm to people, the environment and the economy. The Policy Statement sets out five policy areas which will drive this ambition. These are:

- Upgrading and expanding our national flood defences and infrastructure.
- Managing the flow of water more effectively.
- Harnessing the power of nature to reduce flood and coastal erosion risk and achieve multiple benefits.
- Better preparing our communities.
- Enabling more resilient places through a catchment-based approach.

5.15 The **Flood and Water Management Act 2010 [See reference 118]** and The **Flood and Water Regulations 2019 [See reference 119]** sets out measures to ensure that risk from all sources of flooding is managed more effectively. This includes incorporating greater resilience measures into the design of new buildings; utilising the environment in order to reduce flooding; identifying areas suitable for inundation and water storage to reduce the risk of flooding elsewhere; rolling back development in coastal areas to avoid damage from flooding or coastal erosion; and creating sustainable drainage systems (SuDS).

5.16 A Green Future: Our 25 Year Plan to Improve the Environment [See reference 120]: Sets out goals for improving the environment within the next 25 years. It details how the Government will work with communities and businesses to leave the environment in a better state than it is presently. Actions relating to climate change are as follows:

- Using and managing land sustainably:
  - Take action to reduce the risk of harm from flooding and coastal erosion including greater use of natural flood management solutions.
- Protecting and improving our global environment:
  - Provide international leadership and lead by example in tackling climate change and protecting and improving international biodiversity.

5.17 The **National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting**: Making the country resilient to a changing climate **[See reference 121]**: Sets out visions for the following sectors:

- People and the Built Environment – "to promote the development of a healthy, equitable and resilient population, well placed to reduce the harmful health impacts of climate change...buildings and places (including built heritage) and the people who live and work in them are resilient and organisations in the built environment sector have an increased capacity to address the risks and make the most of the opportunities of a changing climate."
- Infrastructure – "an infrastructure network that is resilient to today's natural hazards and prepared for the future changing climate."
- Natural Environment – "the natural environment, with diverse and healthy ecosystems, is resilient to climate change, able to accommodate change and valued for the adaptation services it provides."
- Business and Industry – "UK businesses are resilient to extreme weather and prepared for future risks and opportunities from climate change."

- Local Government – “Local Government plays a central role in leading and supporting local places to become more resilient to a range of future risks and to be prepared for the opportunities from a changing climate.”

5.18 UK Climate Change Risk Assessment 2017 [See reference 122]: Sets out six priority areas needing urgent further action over the next five years. These include:

- Flooding and coastal change risks to communities, businesses and infrastructure
- Risks to health, well-being and productivity from high temperatures
- Risks of shortages in the public water supply, and for agriculture, energy generation and industry, with impacts on freshwater ecology
- Risks to natural capital, including terrestrial, coastal, marine and freshwater ecosystems, soils and biodiversity.
- Risks to domestic and international food production and trade
- New and emerging pests and diseases, and invasive non-native species, affecting people, plants and animals

5.19 The **national flood and coastal erosion risk management strategy for England [See reference 123]**: This Strategy sets out the national framework for managing the risk of flooding and coastal erosion. It sets out the roles for risk management authorities and communities to help them understand their responsibilities. The strategic aims and objectives of the Strategy are:

- climate resilient places: working with partners to bolster resilience to flooding and coastal change across the nation, both now and in the future in the face of climate change;
- today’s growth and infrastructure resilient in tomorrow’s climate: making the right investment and planning decisions to secure sustainable growth and environmental improvements, as well as infrastructure resilient to flooding and coastal change;

- a nation ready to respond and adapt to flooding and coastal change: ensuring local people understand their risk to flooding and coastal change, and know their responsibilities and how to take action.

5.20 The **UK Low Carbon Transition Plan**: **National Strategy for Climate and Energy** (2009) **[See reference 124]**: sets out a five-point plan to tackle climate change. The points are as follows: protecting the public from immediate risk, preparing for the future, limiting the severity of future climate change through a new international climate agreement, building a low carbon UK and supporting individuals, communities and businesses to play their part.

5.21 The **UK Renewable Energy Strategy [See reference 125]**: Sets out the ways in which we will tackle climate change by reducing our CO_2 emissions through the generation of a renewable electricity, heat and transport technologies.

5.22 Climate Change Act 2008 [See reference 126]: Sets targets for UK greenhouse gas emission reductions of at least 100% by 2050, against a 1990 baseline (this was previously 80% but was updated to a net zero target in June 2019).

5.23 Planning and Energy Act 2008 [See reference 127]: enables local planning authorities to set requirements for carbon reduction and renewable energy provision.

Regional and local

5.24 Thames Estuary 2100 [See reference 128]: The document sets out the Environment Agency's recommendations for flood risk management for London and the Thames Estuary through to the end of the century and beyond. The Plan sets out the future shape of flood risk management, strategic action that is needed and options to achieve this, local actions that are needed, and how the impact of rising sea levels needs to be addressed. Action Zones 5, 6, 7 and 8

covers the sub-region. Actions have been identified which include hard and soft measures including a floodplain management programme, partnership arrangements to ensure that new development is safe, review and maintain future partnership arrangements and principles and management of defences.

5.25 The Thames Estuary 2100 Plan includes policy recommendations for public realm and access improvements, coinciding with other initiatives such as the Thames Gateway Parklands vision, which envisages improved access and connections with local communities. The Plan introduces the riverside strategy approach. This integrates improvements to flood risk management defences into wider redevelopment, enhancing the social, environmental and commercial aspects of the riverside.

5.26 The Plan is also an example of a managed adaptive strategy approach for varying rates of climate change, which is made up of a combination of different interventions that act together to achieve the recommended policy.

5.27 South East Inshore Marine Plan [See reference 129**]**: The Plan introduces a strategic approach to planning within the inshore waters between Suffolk and Kent, including the Thames Estuary. This includes building resilience and adaptations to climate change, as well as consideration of renewable energy and potential for carbon capture and storage.

5.28 Essex Transport Strategy [See reference 130]: The Essex Transport Strategy outlines the County Council's priorities and strategic objectives for improving the transport network across Essex, including by encouraging a modal shift towards public transport, walking and cycling over single occupancy car journeys. The Plan supports the use of cleaner, lower carbon transport technologies, and car share schemes.

5.29 Sustainable Modes of Travel Strategy [See reference 131]: The Sustainable Modes of Travel Strategy aims to reduce the number of private vehicles using the highway network and increase the use of more active and sustainable modes available to businesses, residents and schools within Essex. A key objective is to manage congestion during peak times and improve the

environment by reducing the need to travel by car and potentially reducing CO_2 and other emissions.

5.30 Transport East Active Travel Strategy [See reference 132]: The vision for the region is that half of all journeys within towns and cities (up to three miles from the urban centre) will be made by walking and cycling. By 2050, half of all trips in the Transport East region will be made by walking or cycling. In Thurrock, a "Go Dutch" scenario (which applies Dutch rates for cycle commuting in England adjusting for distance and hilliness) would result in almost a twelve-fold increase of the population who could commute to work by cycle, to 24.9%.

5.31 Transport East Draft Transport Strategy [See reference 133]: The Draft Transport Strategy aims to outline a collective vision for the future of transport in the region and set out key investment priorities needed to deliver it. The overarching vision is underpinned by four strategic priorities: decarbonisation to net-zero, connecting growing towns and cities, energising coastal and rural communities, and unlocking international gateways. The four strategic priorities overlap and together form an integrated strategy for the region. The Draft Transport Strategy sets out the pathways and key goals needed for the delivery of their Vision, which include goals focused around improving sustainable and active travel options, reducing demand for travel via digital connectivity, encouraging behaviour change, increasing access for coastal and rural communities, improving efficiency of freight transport, and creating better connected ports and airports to unlock international gateways.

5.32 Section 5 of the Draft Transport Strategy highlights place-based strategic corridors which link key destinations with the region. For Thurrock, this includes improved links with South Essex, London, Basildon and Southend. The Strategy identifies the area as a major location for economic growth, particularly in relation to the major international ports at London Gateway, Purfleet and Tilbury (now Thames Freeport). At present, the area is heavily congested which acts as a major barrier to growth. The Strategy identifies the need for improved road, freight capacity, passenger rail and bus networks to support economic and population growth in the region.

5.33 South Essex Green and Blue Infrastructure Strategy: Resilient by Nature [See reference 134]: This strategy sets out a vision for an integrated green and blue infrastructure (GBI) network across South Essex and key objectives and projects to achieve this. This includes the protection and enhancement of GBI throughout the region to mitigate and adapt to the effects of climate change.

5.34 Green Essex Strategy [See reference 135]: This Strategy seeks to enhance, protect and create an inclusive and integrated network of high-quality green infrastructure in Greater Essex, to create a county-wide understanding of green infrastructure – its functions and values, and to identify opportunities for implementing green infrastructure. The Strategy recognises the importance of GI in terms of environmental benefits, including climate change mitigation and adaptation. The Strategy highlights the importance of GI in providing ecological networks of all scales, from regional to neighbourhood scale.

5.35 Thurrock Climate Change Scoping Study [See reference 136]: The Thurrock Climate Change Scoping Study was commissioned in 2019 to inform the integration of climate change into the Council's planning policy, in accordance with NPPF. The study's aims are to provide a baseline assessment of the Borough's current climate impacts (emissions) and risks (hazards); summarise existing climate change legislation and policy; review existing documents, local plan processes, policy and operation; outline initiatives to focus on in the Local Plan; and to define what the requirements should be if a climate change strategy were to be developed for the Borough. The study provides a series of recommendations and next steps for the process including stakeholder engagement and establishing timescales and accountability. It also highlights core focus areas and priorities for the Borough including land-use and access issues, carbon emissions relating to buildings, retail and industry, infrastructure, natural resources, the environment and waste.

5.36 Draft Thurrock Transport Strategy (internal draft, currently unpublished): The Interim Draft Transport Strategy builds on the existing Transport Strategy (2013 – 2026), taking into account much of the rapid change Thurrock is undergoing, including major regeneration projects and proposed development

which will fundamentally alter the way people and goods move around Thurrock and the wider region. Key projects include Grays Town Centre regeneration, the port expansion of Tilbury and London Gateway, proposed development of a logistics 'superhub' at Thames Enterprise Park, the Thames Freeport, Purfleet regeneration, and the proposed construction of the Lower Thames Crossing (LTC). The Draft Transport Strategy outlines key challenges and opportunities for Thurrock which include supporting sustainable economic growth, supporting the health and wellbeing of Thurrock's residents and addressing the Climate Emergency. These factors inform the Transport Vision Statement ('Connecting Thurrock'), as well as 10 interconnected overarching goals and nine strategic focus areas specified in the Draft Transport Strategy. The Draft Transport Strategy will be supported by a series of shorter-term delivery documents, setting out more specific actions that aim to achieve the overarching vision and goals.

5.37 Thurrock Transport Strategy 2013-2026 [See reference 137]: The strategy sets out the aims, objectives and policies for delivering transport improvements in Thurrock, including (but not limited to) to respond to large scale growth at Lakeside, Tilbury Port and London Gateway. The strategy focusses on the need to address the following key areas: Delivering Accessibility, Tackling Congestion, Improving Air Quality and Addressing Climate Change, Safer Roads and Facilitating Regeneration. This strategy also sets out the long-term approach to walking and cycling in the Borough.

5.38 Thurrock Local Flood Risk Management Strategy [See reference 138]: This strategy sets out how Thurrock Council, alongside other Risk Management Authorities (RMAs), are responding to identified flood risk in Thurrock. Among other things, the strategy specifies the flood and coastal erosion risk management functions that may be exercised by RMAs, objectives and measures for managing local flood risk and implementation details for these.

5.39 Thurrock Council Level 1 Strategic Flood Risk Assessment [See reference 139]: The SFRA provides an overview of flood risk from all sources across Thurrock. It identified the tidal and fluvial flood plains associated with the

River Thames, main rivers and some ordinary watercourses. A revised Level 2 SFRA will be produced in the near future.

5.40 2020/2021 Air Quality Annual Status Report [See reference 140**]**: The 2020/21 Thurrock Air Quality Annual Status Report provides the most recent overview of air quality within Thurrock, as well as identifying actions that have been undertaken to improve it and the Council's future priorities. The report highlights that the main pollutant of concern in Thurrock is nitrogen dioxide (NO_2), and to a lesser extent particulate matter (PM_{10}), both arising from road traffic emissions. NO_2 was monitored at 67 diffusion tube sites and three automatic monitoring sites across the Borough in 2020. The report notes the limitations of using 2020 data due to the travel restrictions as a result of the COVID-19 pandemic and provides 2019 figures for reference. The Council plans to conduct a detailed and up to date assessment of all declared AQMAs across the Borough.

5.41 Thurrock Air Quality and Health Strategy [See reference 141]: The overarching aim of the strategy is to improve air quality in the Borough in order to reduce the health impacts of air pollution. The report outlines the baseline conditions for both air quality and health in the Borough, and highlights the correlation between the two. It highlights the dangers of certain pollutants and the need to act faster to reduce levels of harmful emissions due to impacts on public health. The report presents a strategy which includes to reduce transport emissions; tackle health inequalities; explore options for the implementation of clean air zones; and ensure air quality policies will be incorporated into future development, regeneration and planning guidance. The strategy also outlines the Air Quality Action Plan (AQAP) for all AQMAs, as well as Borough-wide interventions. The implementation of the strategy will be monitored and progress on air quality assessed.

5.42 Thurrock Council is currently preparing a **Climate Change Strategy**, **Energy Strategy**, **Level 2 Strategic Flood Risk Assessment**, and **Green and Blue Infrastructure Strategy**, all of which will be taken into account in the next iteration of the SEA.

Implications of the policy review for the Interim Thurrock Transport Strategy and SEA

In order to align with the international, national, regional and local policies outlined above, the Interim TTS should seek to ensure that new transport infrastructure is designed to be resilient to climate change impacts. The Interim TTS should seek to reduce transport-related greenhouse gas emissions by:

- reducing the need to travel by diesel and petrol vehicles;
- accelerating a shift from private car to active transport (walking and cycling) and improving low-carbon public transport (electric buses and trains);
- decarbonising road vehicles, including increasing the uptake of electric vehicles;
- facilitating a shift of passenger and freight traffic from road to rail; and
- reducing emissions from ports / port related activities.

The Interim TTS should also seek to reduce carbon emissions from the construction of new/upgraded transport infrastructure by encouraging the use of sustainable construction methods and materials. The Interim TTS should also seek to promote the use of electricity from renewable energy sources in electric vehicles.

The SEA is able to respond to this through the inclusion of SEA objectives relating to the mitigation of climate change, adaptation to climate change, sustainable construction, flooding and sustainable transport.

Baseline information

5.43 Climate change presents a global risk, with a range of different impacts that are likely to be felt within Thurrock across numerous receptors. The Intergovernmental Panel on Climate Change (IPCC) special report on global warming outlines that, under emissions in line with current pledges under the Paris Agreement, **global warming is expected to surpass 1.5°C**, even is these pledges are supplemented with very challenging increases in the scale and ambition of mitigation after 2030. This increased action would need to achieve net zero CO_2 emissions in less than 15 years **[See reference 142]**.

5.44 In light of the IPCC work, Thurrock Council declared a Climate Emergency in October 2019. With this, the Council has committed to reduce its net CO_2 emissions to zero by 2030. Carbon neutrality, therefore, needs to be fully woven into the Interim TTS and form a key part of the SEA process. A Climate Change Partnership Group has now been established in Thurrock. This group is tasked with determining how and when the Council can achieve net zero carbon emissions, as well as how to best leverage the benefits of climate action for other socio-economic goals, leading to the development of targets, pathways, and an action plan for Thurrock to reduce its greenhouse gas emissions in line with the UK's net zero goal **[See reference 143]**.

5.45 Thurrock Council Climate Change Scoping Study highlighted that Thurrock Council is positioned well to integrate climate priorities in its plans as it is a unitary authority. However, because climate issues are transboundary it will be crucial for the Borough to be cooperative across sectors, stakeholders and the public. The study also notes that this level of cooperation could be aided in part by its membership in the Association of South Essex Local Authorities (ASELA) **[See reference 144]**.

Climate change predictions

5.46 The Tyndall Centre for Climate Change Research **[See reference 145]** has undertaken work to calculate the 'fair' contribution of local authorities towards the Paris Climate Change Agreement. Based on the analysis undertaken the following recommendations have been made for Thurrock:

- The Borough should stay within a maximum cumulative carbon dioxide emissions budget of 5.5 million tonnes ($MtCO_2$) for the period of 2020 to 2100. It should be noted that at 2017 carbon dioxide emission levels, Thurrock would use this entire budget within seven years from 2020.
- The Borough should also initiate an immediate programme of carbon dioxide mitigation to deliver cuts in emissions averaging a minimum of -12.9% per year to secure a Paris aligned carbon budget.
- The Borough should reach zero or near zero carbon no later than 2042.

5.47 In general, climate change projections (through UK Climate Projections) indicate a greater chance of hotter, drier summers and warmer, wetter winters in the UK **[See reference 146]**. The UK has experienced a general trend towards warmer average temperatures in recent years with the most recent decade (2009–2018) being on average 0.3C warmer than the 1981–2010 average and 0.9C warmer than 1961–1990. The 21st century is reported so far as being warmer than the previous three centuries.

5.48 Heavy rainfall and flooding events have been demonstrated to have increased potential to occur in the UK as the climate has generally become wetter. For example, the highest rainfall totals over a five-day period are 4% higher during the most recent decade (2008-2017) compared to 1961-1990. Furthermore, the amount of rain from extremely wet days has increased by 17% when comparing the same time periods. In addition, there is a slight increase in the longest sequence of consecutive wet days for the UK. The Environment Agency has developed 'Local flood risk assessments: climate change allowances' **[See reference** 147**]** indicating climate change impacts on peak

rainfall intensity, peak river flows, and sea level rise allowances for local areas. These are outlined later in this Chapter under 'Flood Risk'.

5.49 UK Climate Projections 18 (UKCP18) for the East of England identify the following main changes (relative to 1981-2000) to the climate by the end of the plan period (2038) **[See reference 148]**:

- Increase in mean winter temperature by 1.0°C;
- Increase in mean summer temperature by 1.2°C;
- Increase in mean winter precipitation by 5.0%; and
- Decrease in mean summer precipitation by 10.0%.

5.50 The UK Climate Risk Independent Assessment (CCEA3) identifies a set of 61 specific risks and opportunities to the UK from climate change, some of which are as follows **[See reference 149]**:

Risks

- The number of incidents of food poisoning, heat stress and heat related deaths may increase in summer.
- Domestic energy use may increase during summer months as refrigeration and air conditioning demand increases.
- Wetter winters and more intense rainfall events throughout the year may result in a higher risk of flooding from rivers.
- More intense rainstorms may in some locations result in the amount of surface water runoff exceeding the capacity of drainage systems, consequently leading to more frequent and severe localised flash flooding.
- More frequent storms and floods may cause increased damage to property and infrastructure, resulting in significant economic costs.
- Periods of drought in summer could lead to soil shrinking and subsidence, causing damage to buildings and transport networks.

Drought may also impact negatively on agriculture, industry and biodiversity.

- Warmer and drier summers are likely to affect the quantity and quality of water supply, which will need careful management.
- The changing climate will impact on the behaviour and distribution of species and may encourage the spread of invasive species.

Opportunities

- Milder winters should reduce the costs of heating homes and other buildings, helping to alleviate fuel poverty and reducing the number of winter deaths from cold.
- Domestic energy use may decrease in winter due to higher temperatures.
- Warmer and drier summers may benefit the recreation and tourism economy.
- UK agriculture and forestry may be able to increase production with warmer weather and longer growing seasons.

Carbon dioxide emissions

5.51 In recent years, in line with the UK as a whole, the East of England has seen a decrease in carbon dioxide emissions. One of the main drivers for reduced levels of emissions has been a decrease in the use of coal for electricity generation, accounting for a decrease in emissions for domestic electricity.

5.52 In the East of England, carbon dioxide emissions have fallen from 8.7t per capita to 5.4t per capita (equivalent to a 38% reduction) from 2005 to 2019.

Emissions for Thurrock are now similar to those of East of England falling steadily from 12.7t per capita to 5.3t per capita over the same period, with the exception of 2010, 2012 and 2018 where emissions rose slightly.

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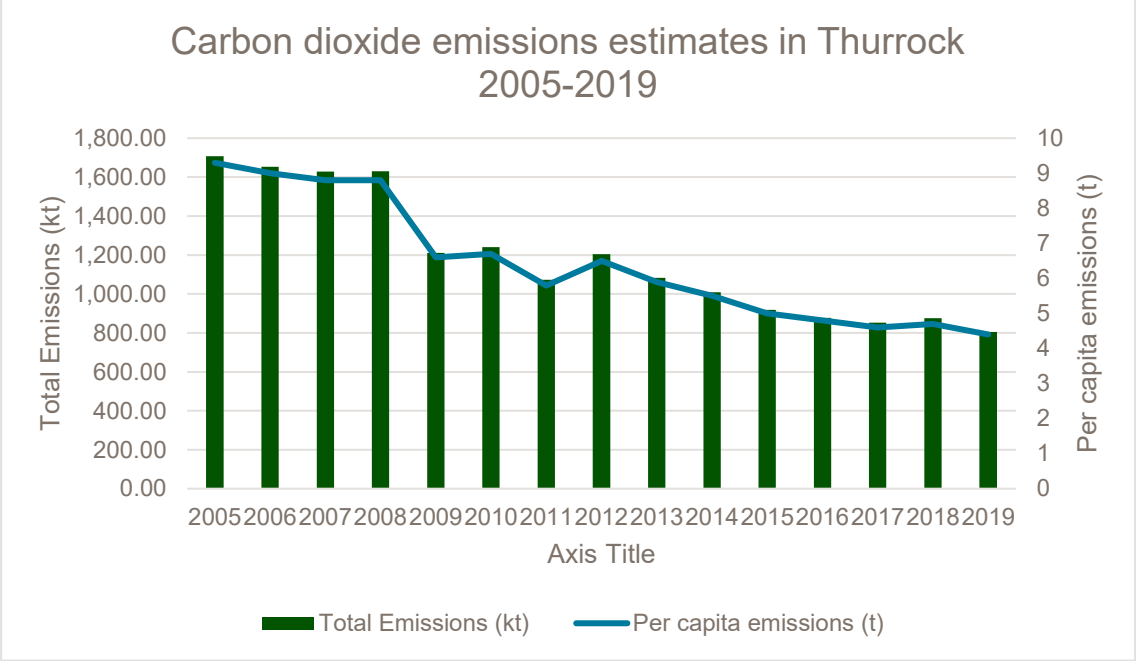
5.55 However, this rate of decrease has been more dramatic in Thurrock compared to East of England statistics, this is also despite the Borough's population increasing by 17% in this period from 148,600 to 174,300. Per capita emissions in the plan area within the scope of influence of the local authority fell most years between 2005 and 2019 as shown in **Figure 5.1** **[See reference 150]**

Figure 5.1: Carbon dioxide emissions estimates in Thurrock 2005-2019



5.56 Although industry was the biggest contributor of CO_2 emissions in 2005, this sector has seen the largest decrease of total CO_2 emissions which is likely due to decline in heavy industry and the closure of Tilbury Power Station **[See reference** 151**]**. In 2019 transport was the biggest contributor to CO_2 emissions in Thurrock as shown in **Table 5.1 [See reference 152]**.

Table 5.1: Changes in carbon dioxide emissions by sector for the region and Borough between 2005 and 2019

Source of Emissions (kt)	East England	East England	Thurrock	Thurrock
	2005	2019	2005	2019
Industry	8,983.6	5,242.7	607.1	152.4
Commercial	6,040.4	2,725.5	396.7	109.3
Public Sector	1,966.5	959.1	89.4	27.2
Domestic	14,068.5	8,678.9	333.1	198.8
Transport	14,360.7	13,513.9	471.7	436.7
Grand Total	48,439.7	33,932.8	1,893.3	916.3

5.57 .

5.58 Figure 5.2 shows the per capita carbon dioxide emissions for Thurrock compared to the surrounding.

SEA of the Thurrock Transport Strategy
for Thurrock Council

LUC

Figure 5.2: Per Capita CO2 Emissions

Thurrock Council boundary
Neighbouring authority boundary

CO2 emissions per capita (tonnes) - 2019

- 38
- 39 - 76
- 77 - 105
- 106 - 114
- 115 - 184
- 185 - 263
- 264 - 269
- 270 - 370

0 5 10 km

Map scale 1:125,000 @ A3

THURROCK COUNCIL

CB:AHB EB:Tomlinson_J LUC FIG6_1_6999_CO2_A3L 26/04/2022
Source:LUC, TC, DEFRA, ONS

Energy consumption and generation

5.59 The Department for Business, Energy & Industrial Strategy produced the following consumption figures for Thurrock in 2019 **[See reference** 153**]** (see **Table 5.2**):

- Coal - a total of 0.8ktoe (thousands of tonnes of oil equivalent) predominantly through domestic use.
- Manufactured fuels - a total of 0.5ktoe predominantly through domestic use.
- Petroleum - a total of 144.7ktoe predominantly from road transport.
- Gas - a total of 114.9ktoe predominantly through domestic use.
- Electricity - a total of 82.6ktoe predominantly through industrial and commercial use.
- Bioenergy and wastes - a total of 12.3ktoe, predominantly through road transport.

5.60 Between 2005 and 2019 the total reported energy consumption for the Borough fell from 1,331.8ktoe to 355.9ktoe. The changes in consumption by energy type are shown in **Table 5.2.** With the exception of energy from biomass and wastes, the consumption of all energy types fell during the same period.**[See reference 154]**

Table 5.2: Energy consumption in Thurrock by type

Energy type	Energy consumption in ktoe (2005)	Energy consumption in ktoe (2019)
Coal	20.6	0.8
Manufactured fuels	139.8	0.5
Petroleum	740.2	144.7

Energy type	Energy consumption in ktoe (2005)	Energy consumption in ktoe (2019)
Gas	330.7	114.9
Electricity	97.5	82.6
Bioenergy and wastes	2.9	12.3
Total	**1,331.8**	**355.9**

5.61 Thurrock has increased its capacity to generate electricity from renewable sources from 2014 to 2020 from 68.6MW installed capacity to 112.84MW installed capacity. Capacity for solar power, onshore wind and plant biomass has accounted for the majority of installed renewable energy capacity in Thurrock during this period. Plant biomass saw the largest increase in this time from 0MW to 41.14MW, the largest share of installed capacity. Landfill gas also makes up a significant portion of capacity, however this decreased slightly in this period from 43.7MW to 39.8MW. Energy generation from renewable sources also increased during this period from 267,104MWh in 2014 to 412,409.07MWh.

5.62 Considering the year-on-year trend of renewable electricity generation in Thurrock the 2020 figure was an increase on the 2019 figure of 69,131MWh. This is almost two times more than the increase in renewable energy generation experienced across the UK and England which grew by 20% and 12.6% from 2019 to 2020, respectively **[See reference** 155**]**.

Road travel and associated energy consumption

5.63 Carbon emissions for the UK in 2020 fell by 10.7% from 2019 levels. Despite a 12% decrease from the previous year due to the impacts of COVID-19, in 2020 transport was still the largest source of carbon dioxide in the UK,

accounting for 29.8% of total emissions. The majority of emissions from transport in the UK are from road transport **[See reference** 156**]**.

5.64 Thurrock benefits from good transport and connectivity to the wider Essex region, Kent, east and central London, and international destinations via the Port of Tilbury. The Borough is served by significant road transport networks, included being intersected by two of the country's busiest major roads, the M25 and A13 **[See reference** 157**]**.

5.65 The most recent census data (2011) shows that out of a population of 158,000, 43,076 Thurrock residents lived and worked in Thurrock and 31,956 commuted to other areas for work. At this time, 18,141 people worked in Thurrock but commuted from other areas. The significant proportion of Thurrock residents that out-commute for work is due in particular to the Borough's close proximity to the capital and may also be contributed to by rising house and office prices pushing people out of London **[See reference** 158**]**. As of 2011, 34.3% of Thurrock residents commuted to London on a daily basis, mainly by car **[See reference** 159**]**. Though more recent data is not available, it is likely that COVID-19 has significantly impacted commuter numbers in recent years.

5.66 As seen in **Table 5.3**, as of 2011, out of a total of 114,124 Thurrock residents, the most popular mode of transport to travel to work was by car or van (41%), followed by the train (11%) and walking (4%). A similar picture was seen in the East of England, where out of 4,245,544 residents, 1,757,121 (41%) drove a car or van to work, 288,663 (7%) walked and 205,077 (5%) took the train **[See reference** 160**]**.

Table 5.3: Method of travel to work by residents in East of England and Thurrock (2011)

Method of travel to work	East of England	Thurrock
All categories	4,245,544	114,124

Method of travel to work	East of England	Thurrock
Work mainly at or from home	161,428	2,258
Underground, metro, light rail, tram	33,110	1,392
Train	205,077	11,992
Bus, minibus or coach	106,303	2,892
Taxi	13,227	484
Motorcycle, scooter or moped	22,475	797
Driving a car or van	1,757,121	47,281
Passenger in a car or van	143,749	4,234
Bicycle	100,651	1,097
On foot	288,663	4,588
Other method of travel to work	17,708	405
Not in employment	1,396,032	36,704

5.67 The areas of Havering (3,674 commuters), Basildon (3,470 commuters), Castle Point (1,638 commuters), Barking and Dagenham (1,396 commuters) and Southend-on-Sea (1,192 commuters) account for the largest inflows of commuters to Thurrock (see **Figure 5.3**). The areas of Basildon (2,943 commuters), Havering (2,693 commuters), Castle Point (1,446 commuters) and Southend-on-Sea (971 commuters) account for the largest numbers of people travelling to the Borough for work by car or van.

5.68 Large numbers of commuters (many by car or van) travel out of Thurrock to Basildon (5,310 commuters, 4,295 by car or van), Westminster, City of London (5,265 commuters, 516 by car or van), Havering (3,429 commuters,

2,775 by car or van) and Tower Hamlets (2,630 commuters, 974 by car or van) (see **Figure 5.4)** **[See reference** 161**]**.

Figure 5.3: Flows of commuters in and out of the Borough (total) (2011 Census)

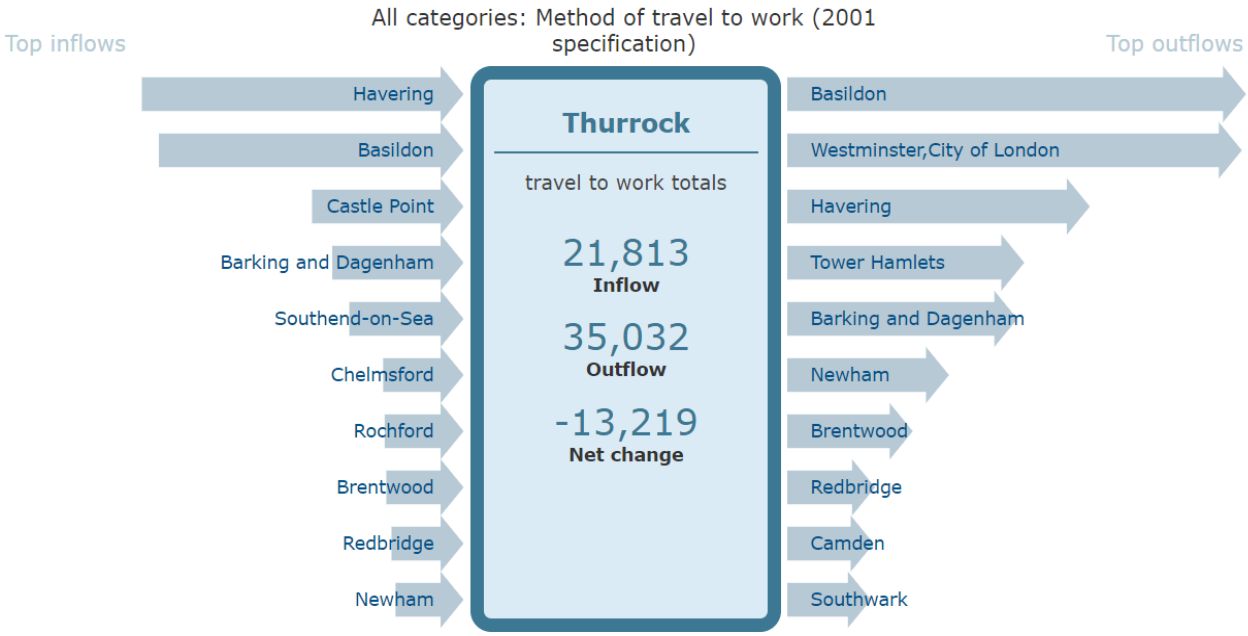
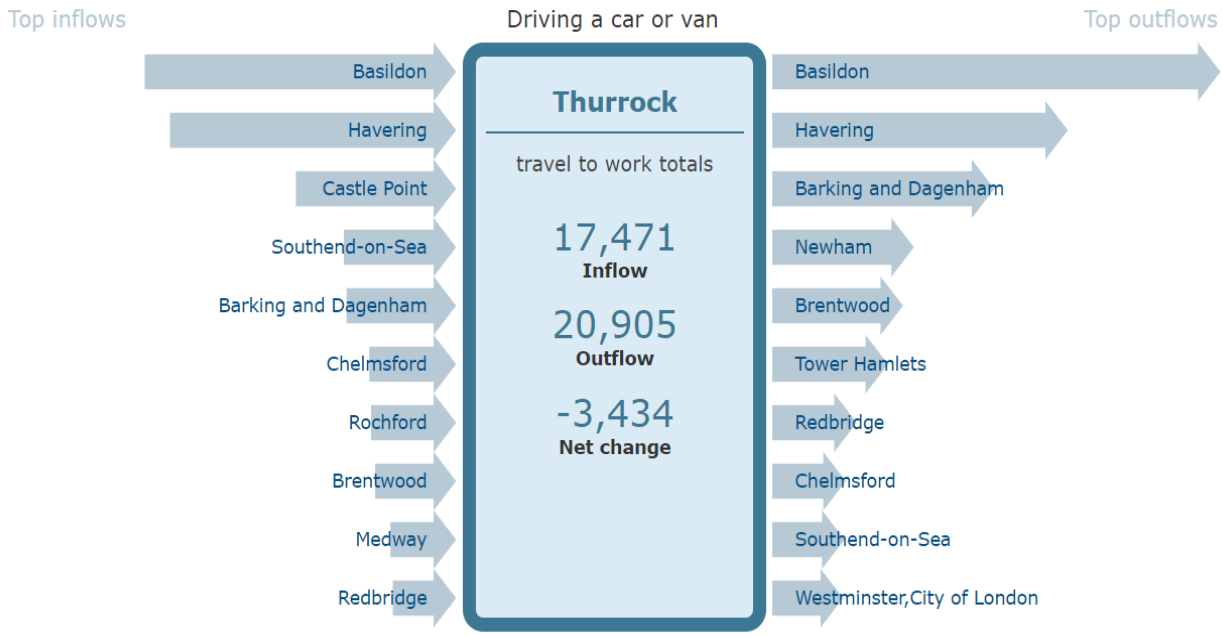


Figure 5.4: Flows of commuters in and out of the Borough (by car or van) (2011 Census)



5.69 Road transport accounts for more than half of oil demand in the UK and relies on petrol and diesel to meet around 98% cent of its energy needs. This has implications for carbon emissions considering the regular need to travel for both residents and those undertaking business.

5.70 The overall road energy consumption in Thurrock decreased between 2005 and 2019 from 136,398t of equivalent oil to 141,985t of equivalent oil. This change was most influenced by the decreasing energy consumption for personal road travel which fell during this period from 79,795t of equivalent oil to 73,615t of equivalent oil. During this period energy consumption recorded in Thurrock for freight uses actually rose from 56,603t of equivalent oil to 68,370t of equivalent oil **[See reference** 162**]**.

5.71 Recent trends across the UK indicate that diesel consumption excluding biodiesel fell in 2018 for the first time since 2009. The trend is due in part to a slowing of growth in the diesel vehicle fleet following sharp drops in new registrations as well as increased efficiencies. It is expected that the UK will

diversify in road transport to include more electric and ultra low emissions vehicles in the coming years **[See reference** 163**]**.

5.72 As of January 2022, there were 28,375 public electric vehicle charging devices available in the UK and of these, 5,156 were rapid charging devices. Within Thurrock there are a total of 18 public electric vehicle charging devices and 11 of these are rapid charging devices. 12 additional locations have been identified for the initial roll out of electric charging facilities by the end of 2022. There are approximately 10 charging devices per 100,000 population. The Borough performs worse than the UK average of 42.3 charging devices per 100,000 population. Thurrock is within the bottom 20% of local authorities in terms of this measure **[See reference** 164**] [See reference** 165**]**.

Flood risk

5.73 Flood risk in the Borough is implicitly linked to climate change considering the changes predicted in weather patterns and the impact this will have on sea level rise and subsidence, both of which could lead to more frequent flooding in Thurrock. According to UK Climate Change Projections made in 2018, the East of England region including Thurrock is predicted to experience an increase in winter rainfall of 5% and a decrease in summer rainfall of 10% by 2038 **[See reference** 166**]**.

5.74 Thurrock is affected by flooding from several sources: tidal, fluvial, surface water, ordinary watercourses, sewer and groundwater (see **Figure 5.5**). Tidal and fluvial sources are likely to be the main risk of future flooding in Thurrock, particularly from high tidal water levels in the Thames Estuary and in the north of the Borough from the River Mardyke from storm surges coupled with high spring tides. Flooding has been an issue in Thurrock, especially in recent years, with large areas of the Borough located within flood risk zones 2 and 3, especially in areas immediately adjacent to the River Thames and along the River Mardyke **[See reference** 167**]**. Approximately 11,000 properties in Thurrock are estimated to currently be at risk of tidal flooding, and several hundred at risk of fluvial flooding, particularly in the areas of Tilbury, Purfleet

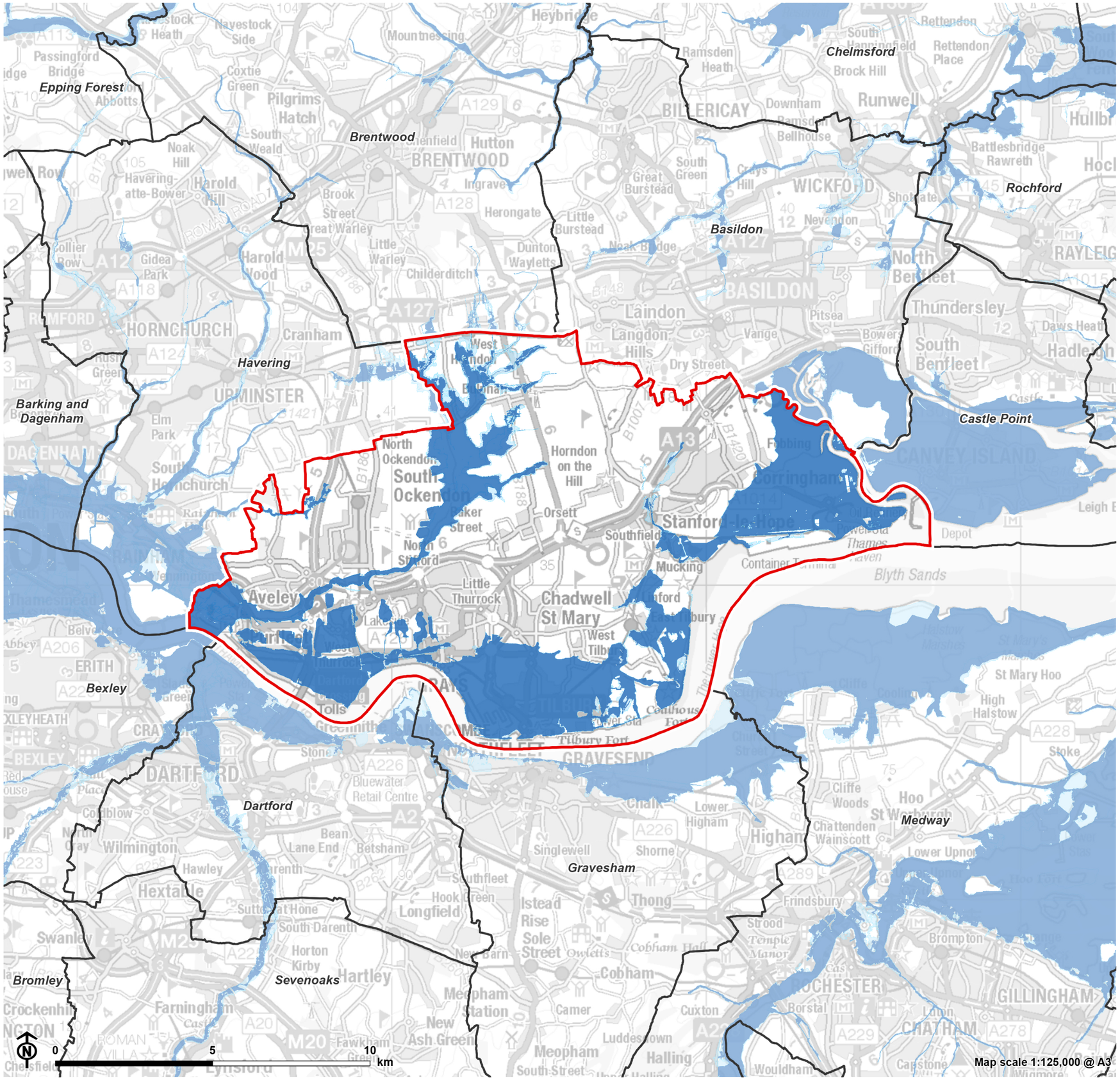
and West Thurrock. Other areas vulnerable to flooding include commercial and industrial developments such as the Port of Tilbury, DP World London ports, Lakeside Retail Park, and transport assets including the c2c mainline, the A13 and the Thames Lower Crossing **[See reference** 168**]**. Coalhouse Fort (Scheduled Monument) and Coalhouse Fort Park are assets that are highly vulnerable to current-day tidal flood risk as the low-lying embankment adjacent to the Thames Estuary has overtopped at least once a year for the past three years. This risk will increase with the impacts of projected sea-level rise **[See reference** 169**]**.

5.75 Surface water flood risk is widespread across Thurrock, with the highest risk located in the more urbanised areas, with Stanford-Le-Hope and parts of Grays expected to see the largest amounts of surface water flooding in an extreme rainfall event **[See reference** 170**]**.

5.76 There are currently a number of flood defences in place, including the Thames Barrier, which is located seven kilometres upstream from Thurrock, and concrete seawalls that protect Thurrock from tidal surge events with a 0.1% chance of occurring in any one year. The present defence height along the Thurrock foreshore, according to the Environment Agency, varies between 6.9m AOD (above ordnance datum) and 7.2m AOD. This provision roughly resembles the 1 in 1,000-year peak tide range for the year 2109. A large flood storage area to the north of Tilbury town strategically protects the town from pluvial run-off coming from higher ground to the north **[See reference** 171**]**.

LUC

Figure 5.5: Flood Risk



CB:AHB EB:Tomlinson_J LUC FIG6_4_6999_Flood_A3L 26/04/2022
Source:LUC, TC, EA

THURROCK COUNCIL

Key environmental issues and likely evolution of these issues without the Interim Thurrock Transport Strategy

5.77 There is a need to significantly reduce the Borough's greenhouse gas emissions to help meet international and national greenhouse gas reduction targets. This can be achieved through:

- Reducing the need to travel by diesel and petrol vehicles. Transport is the largest contributor to carbon dioxide emissions in Thurrock. However, this will be challenging due to its intersection by significant road transport networks and given current levels of in and out commuting by car, primarily commuting to Basildon to the east and towards London to the west (Basildon, Havering, Barking and Dagenham, and Newham).
- Accelerating a shift from private car to active transport (walking and cycling) and improving low-carbon public transport (electric buses and trains).
- Decarbonising road vehicles including increasing the uptake of electric vehicles powered by electricity generated from renewable energy sources as the Borough performs worse than the UK average of 42.3 charging devices per 100,000 population (Thurrock is within the bottom 20% of local authorities in terms of this measure).
- Facilitating a shift of passenger and freight traffic from road to rail.
- Reducing emissions from ports / port related activities.
- Encourage the use of sustainable construction methods and materials in the development of transport infrastructure, with a focus on reducing the embodied carbon in new transport infrastructure.

5.78 The effects of climate change in the Borough are likely to result in extreme weather events (e.g., intense rainfall and flooding, prolonged high temperatures and drought) becoming more common and more intense. Of prominence to

Thurrock is increasing flood risk, especially in the urbanised south of the borough by the River Thames, and also increasing heatwaves and droughts in the summer. Climate change is therefore likely to affect habitats and species and how people live, work and play. Climate change and flooding will adversely affect Thurrock with or without the Interim TTS. However, the Interim TTS provides an opportunity to adapt and mitigate to climatic factors by promoting sustainable development of transport infrastructure, for example by locating transport infrastructure in sustainable locations that would not be significantly impacted by flooding (or likely to increase flooding elsewhere) and ensuring it is designed to be flood resilient; reducing the need to travel; creating and enhancing green and blue infrastructure networks; incorporating Sustainable urban Drainage Systems (SuDS) as part of new transport schemes; and through low carbon design of new transport infrastructure and the use of renewable energy for electricity in electric vehicles.