Climate adaptation & mitigation guidance

Content

Introduction

Supporting the Norfolk Coast National Landscape (NCNL) Management Plan, this guidance is designed to empower those living and working within/around our protected landscapes to successfully adapt to and mitigate against climate change. This document sets out why action is needed and what resources are available to support.

Purpose of this guidance

- Simple and clear advice about climate mitigation and adaptation around the Norfolk coast.
- Empower people to take action.
- Support the NCNL's special qualities that are impacted by ongoing climate change.

Aimed at:

- Developers
- Planners
- Decision-makers
- Public

Please note: climate change will impact the natural environment as well as people. Specific guidance on nature adaptation is covered separately in the nature recovery guidance.

Climate change in Norfolk

Climate change is the long-term change in climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere, and which is in addition to natural climate variability.

Climate change is leading to changes in temperature, precipitation and sea levels, as well as more extreme weather events such as heat waves, flooding, wildfires, and droughts. Action is needed on two fronts:

- **Mitigation** - actions to reduce or prevent greenhouse gas (GHG) emissions that contribute to minimising climate change.
- **Adaptation** - action to help cope with and reduce the impacts of climate change.

Norfolk Coast Protected Landscape (NCPL) recognises the serious impacts of climate change and the need for urgent action. The Norfolk coast is located within the Eastern England climate region. Average maximum summer temperatures are between

20°C and 22°C. Average maximum winter temperatures are between 7°C and 8°C. Much of eastern England receives less than 700mm of rainfall per year, with rainfall spread relatively evenly across the seasons. Average wind speeds for this region are also low, although the region does have the greatest frequency of tornadoes in the UK[1].

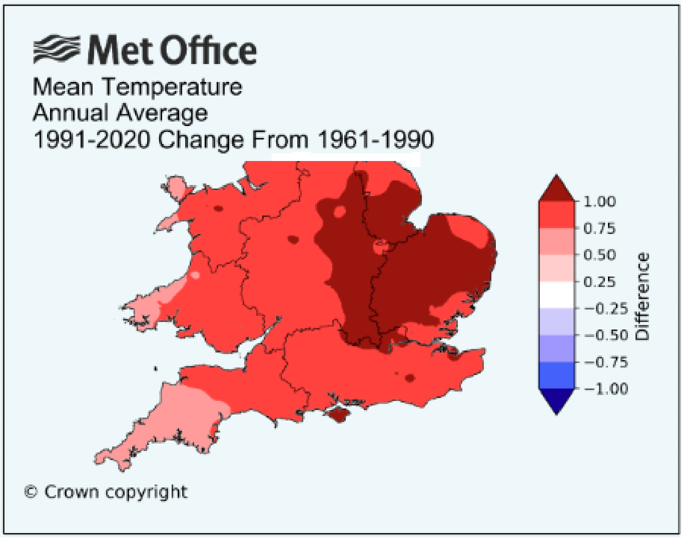
The Norfolk coast's climate is already changing. Figure 1.1 presents the changes in annual mean temperature and rainfall from 1991-2020 compared to a baseline period of 1961-1990 (ibid). Climate change impacts already experienced include:

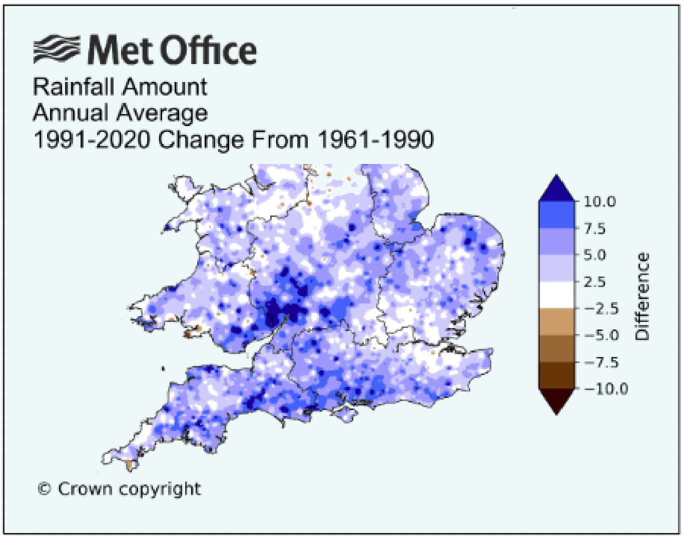
- Flooding events, such as the 2023 Potter Heigham flooding.
- Coastal erosion, such as at Happisburgh.
- Heavy rainfall, such as the 2024 heavy downpours amid Storm Conall.
- Landslides, such as the 2024 cliff collapse north of Trimingham.
- Wildfires, such as the 2022 wildfire event in Norfolk that led to damage to about twenty homes and damage to much-loved natural landscapes and wildlife.
- Heatwaves, such as the 2024 summer heatwave hitting Norfolk in July.
- Drought, such as the 2023 drought conditions in North Norfolk impacting farmers.

The Met Office UK Climate Projections 2018 (UKCP18) provides up-to-date information on the future climate projections for the UK[2]. These suggest that the UK will likely experience warmer, wetter winters and hotter, drier summers.

Each local area will experience its own unique challenges from climate change. The amount of climate change will depend on how much GHG the world emits; however, we are already locked into some changes in climate as a result of GHGs already emitted, regardless of future reductions in emissions. The Local Authority Climate Service provides non-technical climate summaries for Local Authorities in the UK for different levels of global warming (1.5°C, 2°C, 4°C) relative to the pre-industrial baseline (1850-1900)[3].

Figure 1.1 Observed changes in Norfolk





Adapted from Met Office Local Authority Climate Service

The table below presents the projected changes in climate for North Norfolk for two global warming levels – 2°C and 4°C. The global warming levels indicate what the local climate will look like if global average temperatures increase by either 2°C or 4°C above pre-industrial levels. It should be noted that we have already reached +1.2°C of global warming.

[1] Met Office, 2024. Local Authority Climate Service. https://climatedataportal.metoffice.gov.uk/pages/lacs
[2] Met Office, 2022. UK Climate Projections: Headline Findings. https://tinyurl.com/yvu4rmb2
[3] Met Office, 2024. Local Authority Climate Service. https://climatedataportal.metoffice.gov.uk/pages/lacs

Table 1.1: Local climate projections for North Norfolk

Climate variable	2°C increase (in global temperature)	4°C increase (in global temperature)
Summer average temperature	+2°C	+3.9°C
Winter average temperature	+1.3°C	+2.7°C
Summer precipitation rate	+1%	-21%
Winter precipitation rate	+1%	+10%

Adapted from the Met Office, 2024. Local Authority Climate Service

UKCP18 also provides projections of sea level rise. Sea levels in the area are expected to rise over the 21st century, up to 30cm by the 2050s and 49cm by the 2080s, although larger increases cannot be ruled out. This raises the risks of further coastal erosion and flooding.

A full report of the climate projections for North Norfolk is available through the Local Authority Climate Service.

Key anticipated impacts of projected future climate changes for the Norfolk coast are summarised below:

- An increase in summer days with a maximum temperature exceeding 25°C and hot summer days with a maximum temperature exceeding 30°C.
- An increase in the number of days that are suitable for food growing (when daily mean temperature exceeds 5.5°C).
- A reduction in energy demand for heating, due to fewer cooler days (below 15.5 °C), but an increase in energy demand for cooling due to more warmer days (over 22 °C).
- A decrease in disruptions from frost days, when the daily minimum temperature is below 0°C.

The UK Climate Change Risk Assessment indicates that the frequency and intensity of **extreme temperature and rainfall events** is also likely to increase in future, with the extent of change depending on global efforts to reduce GHG emissions[4]. The anticipated impacts of such extreme events for the Norfolk coast include:

- Increased risk of flooding from heavy rainfall and rising sea levels, causing damage to homes, businesses and infrastructure (e.g. energy and transport) and disrupting services.
- Risk to water supplies for homes and businesses from increased water scarcity and drought.
- Saltwater intrusion of aquifers and agricultural land as a result of sea level rise, storm surges and high tides, which can increase the salinity (salt content) of farmland and aquifers.

The potential impacts of climate change highlight the need for climate action to reduce GHG emissions and adapt to the changing climate. Councils within Norfolk recognise the local impacts of climate change as well as the role the area will play in supporting national climate mitigation and adaptation efforts.

Strategies in action

Several actions and projects are already in place to reduce emissions and respond to the impacts of climate change around The Wash and Norfolk coast.

- Norfolk County Council has:

  - adopted a net zero target for 2030.

  - launched a Climate Strategy.

  - secured an additional £4.45 million from Active Travel England to enhance active travel infrastructure.

[4] Evidence for the third UK Climate change Risk Assessment (CCRA3). Summary for England. https://www.ukclimaterisk.org/publications/summary-for-england-ccra3-ia/

- planted 600,000 trees as part of the 1 Million Trees for Norfolk project.

- North Norfolk District Council has:

  - adopted a net zero target for 2030.

  - adopted an Environmental Charter.

  - commenced an ambitious tree planting programme.

  - supported renewable energy projects such as the installation of the 150kW solar array on the roof of their headquarters in Cromer, which has reduced emissions by up to 23.2 tonnes of CO_2e annually.[5]

  - supported electric vehicle infrastructure through funding for deployment of over 30 electric vehicle charging points (EVCPs) at council sites.

  - provided support for retrofitting existing buildings e.g. through securing funding to provide improvements to energy efficiency in homes occupied by low-income households.

- The Borough Council of King's Lynn & West Norfolk's retrofit exercises, under the Re:fit framework, facilitated the installation of numerous energy conservation measures in buildings, including solar photovoltaics, heat pumps, LED lighting, insulation upgrades and Combined Heat and Power units.

- Great Yarmouth Borough Council's Coastal Adaptation Supplementary Planning Document seeks to help with the impacts of coastal erosion.

- Active engagement on climate change is being sought with stakeholders and residents, including through the Norfolk Climate Change Partnership and Net Zero East.

Climate mitigation

Climate mitigation refers to the efforts made to reduce or prevent the emission of greenhouse gases. This includes transitioning to renewable energy sources and sustainable modes of transportation, improving energy efficiency, and enhancing carbon sinks like forests.

This section provides guidance on mitigation actions related to reducing emissions from buildings and new developments through architectural design and the installation of renewable energy sources and electric vehicle infrastructure.

Reducing greenhouse gas emissions from buildings

The UK built environment is currently responsible for about 25% of total UK greenhouse gas (GHG) emissions[6]. Therefore, it is important to address the GHG emissions associated with buildings to reduce overall emissions around The Wash and Norfolk coast. This includes consideration of existing buildings, which are part of the current landscape, and new buildings in the area.

Existing buildings/developments

Approximately 18% of our annual national CO_2e emissions come from existing homes, which are estimated to represent 80% of the homes that will be standing in 2050[7]. Energy Performance Certificate (EPC) ratings indicate the energy efficiency of buildings based on data about a building's energy features, such as the building materials used, the heating systems and the insulation. The median EPC score of all dwellings up to the financial year ending 2024 was 64 in North Norfolk, 65 in King's Lynn and West Norfolk, and 67 in Great Yarmouth[8]. Their ratings are on a scale of 1 (least efficient) to 92+ (most efficient). Whilst the median EPC ratings of *new dwellings* across the three Local Authorities are generally quite high (83-84), the ratings for existing dwellings are substantially lower at 62-66. These figures show that a significant portion of the existing building stock is relatively inefficient and that more work is needed to upgrade their energy efficiency.

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[5] Carbon Dioxide Equivalent or CO_2 equivalent (abbreviated as CO_2e or CO_2-eq) is a metric used to compare the emissions of various greenhouse gases based on their global warming potential, by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.

[6] UKGBC, 2023. Net Zero Carbon Buildings and Infrastructure. UKGBC. https://ukgbc.org/wp-content/uploads/2023/02/Net-zero-carbon-buildings-and-infrastructure-pdf.pdf

[7] LETI, 2021. Climate Emergency Retrofit Guide. https://www.leti.uk/retrofit

[8] Office of National Statistics, 2024. https://www.ons.gov.uk/peoplepopulationandcommunity/housing/articles/energyefficiencyofhousinginenglandandwales/2024

The principal options for reducing emissions from existing buildings relate to retrofitting measures aimed at improving energy and water efficiency, thereby reducing operational GHG emissions. This can also help to ensure that existing buildings stay in use, thereby avoiding the GHG emissions associated with demolishing existing buildings and constructing new buildings. Existing buildings should be maintained and refurbished where possible to reduce emissions associated with new developments.

A summary of key measures that can be adopted to improve the energy efficiency and water efficiency of existing buildings is presented in the table below.

Table 1.2: Summary of typical retrofit measures

Building element	Retrofit action
Walls	Add external and/or internal insulation
Roofs	Insulate roof spaces
Floors	Insulate between joists and/or excavate and insulate below floors
Windows and doors	Replace with better insulated, air-tight units
General building envelope	Mitigate any breaks in insulation (thermal bridging) where possible, and implement draught proofing, sealing of chimneys and vents for airtightness
Heating systems	Adopt fossil fuel-free building systems e.g. ground source heat pumps
Hot water	Increase insulation or replace hot water tanks, insulate all pipe work, install low-flow fittings, and consider solar water heating
Renewables	Adopt rooftop solar photovoltaics

Adapted from LETI's Climate Emergency Retrofit Guide

The type and scale of retrofitting undertaken should be tailored to the property type and relevant constraints e.g. heritage or visual appearance.

Useful retrofitting guidance for dwellings and non-domestic buildings, including historic buildings, includes:

- LETI's Climate Emergency Retrofit Guide.
- the Passivhaus and EnerPHit retrofit guide.
- The Energy Saving Trust's range of guidance on energy efficiency, renewables and heating.
- Historic England's range of technical advice guides on retrofitting historic buildings.
- UKGBC's guidance aimed at encouraging retrofits in commercial buildings.

New developments

GHG emissions from new developments contribute significantly to the local carbon footprint. These include emissions from the construction process (including the extraction, processing and transportation of materials) and emissions from operation (e.g. heating, hot water, lighting and electrical appliances).

The UK Building Regulations set out the current standards for buildings in England. These include standards for the energy performance of buildings and primarily address emissions from controlled fixed services such as heating, cooling, ventilation, and lighting. Embodied carbon in materials, transport emissions and operational emissions from appliance use (such as IT equipment, televisions, and kettles) are excluded but can also be significant sources of emissions.

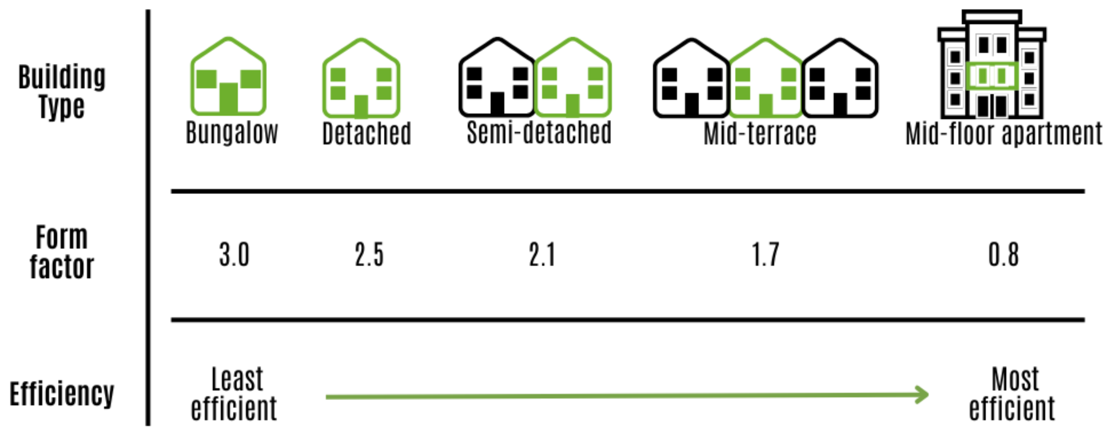
To significantly reduce GHG emissions in new buildings, a holistic approach that goes beyond the requirements of the UK Building Regulations is needed that seeks to deliver buildings with low embodied carbon and low or zero emissions from operation that are supported by sustainable transport infrastructure (e.g. public transport, safe cycle routes, electric vehicle charging).

Key measures that will help lead to low-carbon developments and net zero carbon developments include:

- **Installing fossil fuel-free heating and hot water generation**: This could include the use of heat pumps, solar thermal systems, biomass boilers and district heating systems.
- **Specifying effective ventilation**: Including the use of Mechanical Ventilation with Heat Recovery (MVHR), which provides background ventilation (by extracting moist warm air from kitchens and bathrooms, exchanging the heat for incoming cold fresh air, and then supplying the air to the other rooms in the home) and natural ventilation.
- **Incorporate on-site renewable energy** and consider installing battery storage to maximise the use of the energy generated within the building.
- **Use of low-carbon or sustainable building materials:**
- reuse materials and products from demolished buildings.
- ensure the building is designed for disassembly, such that its materials and products can be re-used in future buildings.
- substitute high-carbon materials like steel for low-carbon materials.

  For further information see the UK Green Building Council's (UKGBC) comprehensive guidance document on applying 'circular economy' principles on construction projects.
- **The 'Fabric First' approach**: This approach to building design involves maximising the performance of the components and materials that make up the building's fabric before considering the use of mechanical or electrical systems. It can help to reduce capital and operational costs, improve energy efficiency, reduce carbon emissions and reduce ongoing maintenance costs, with these measures all helping to reduce emissions from new developments. Some of the key 'Fabric First' approach measures include:
  - specifying high levels of insulation and air tightness to minimise heat loss and heating requirements.
  - considering a buildings' form for reducing heat loss (Figure 1.2). More compact and simple building forms have a smaller surface area leading to lower heat loss. A building's 'form factor' is used as a measure of a building's efficiency.
- considering a building's orientation for optimising solar gains, reducing heating demand, and preventing overshadowing in winter (Figure 1.3). A building's orientation, combined with its glazing ratio, is key to minimising energy demand. In the UK, over the course of a year, north-facing windows nearly always lead to net heat loss, whereas south-facing ones can normally be designed to achieve a net heat gain[9]. However, the amount of south-facing glazing should also be optimised to prevent the risk of summer overheating (discussed in subsequent sections).

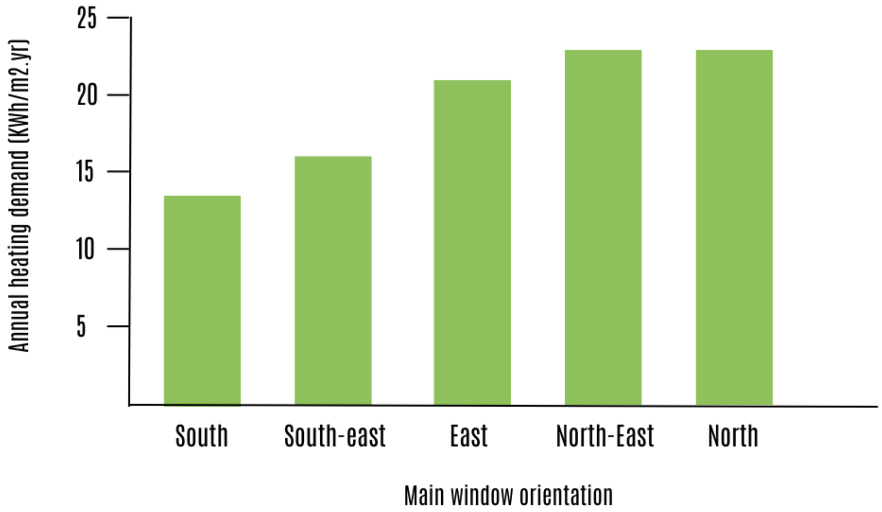
Figure 1.2: Types of homes and their form factor.



Adapted from LETI, 2021. Climate Emergency Design Guide

[9] LETI, 2021. Climate Emergency Retrofit Guide. https://www.leti.uk/retrofit

Figure 1.3: Impact of orientation on heating demand.



Adapted from LETI, 2021. Climate Emergency Design Guide

Useful guidance documents for further information on reducing emissions from new developments include:

- LETI's Climate Emergency Design Guide.
- The Passivhaus Trust's Passivhaus Easi Guide.

A positive example

In **Burnham Overy Staithe** (North Norfolk), there is a terrace of three dwellings that have been built to the internationally recognised low energy build 'Passivhaus standard'. These dwellings incorporate a compact form, north-facing windows, the use of wet plaster to deliver airtightness, high-performing insulation and non-fossil fuel heating, while still integrating seamlessly into the local context, reflecting traditional style cottages.

Reducing GHG emissions from car use linked to development

Transport is the largest contributor to UK domestic greenhouse gas emissions, responsible for 28% of all emissions in 2022[10]. In North Norfolk, total emissions from transport amount to about 27% of total territorial greenhouse gas emissions; this compares to 20% of total emissions for King's Lynn and West Norfolk and 32% for Great Yarmouth[11]. Addressing transport emissions will therefore play a key role in reducing GHG emissions.

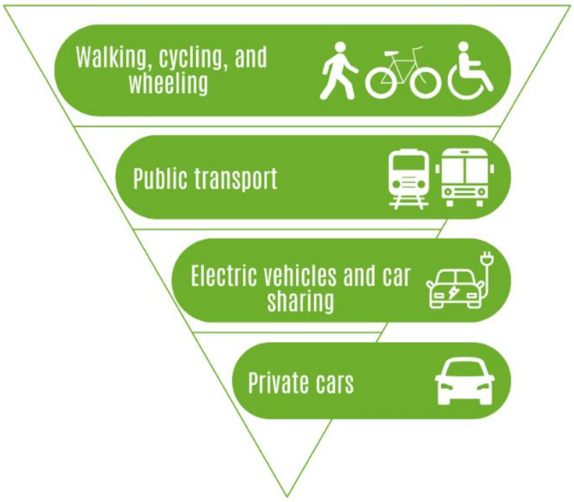
Options that could be considered to reduce transport-related emissions from new developments include:

Development location and supporting travel infrastructure: Where possible, new developments should be located and designed to support and encourage sustainable modes of transport e.g. walking, cycling, public transport. This could include:

- well designed, direct bike routes, with secure cycle parking.
- ensuring larger developments provide a range of uses (e.g. shops, GP) so that many needs can be met without using a car.
- conveniently located for public transport links.

Figure 1.4: The sustainable travel hierarchy

[10] DESNZ, 2023. 2022 UK Greenhouse Gas Emissions, Final Figures. https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2022
[11] https://naei.energysecurity.gov.uk/laghgapp/



Electric vehicle infrastructure: There is a significant reliance on cars in rural locations such as Norfolk and so, to address emissions from private car use while meeting the needs of car users, it is essential to support electric vehicles. Electric vehicle charging infrastructure should be provided as part of new development and at key locations.

Digital connectivity: Ensuring strong broadband connectivity as part of new development can reduce the need to travel and, in turn, reduce associated GHG emissions by enabling:

- home working.
- access to digital health services.

Climate adaptation

Climate adaptation refers to the adjustments needed in response to the changing climate. This includes adapting structures and systems, such as infrastructure, the built environment, water use and food production.

This section provides guidance on adaptation actions related to water use and managing the risk of overheating in buildings.

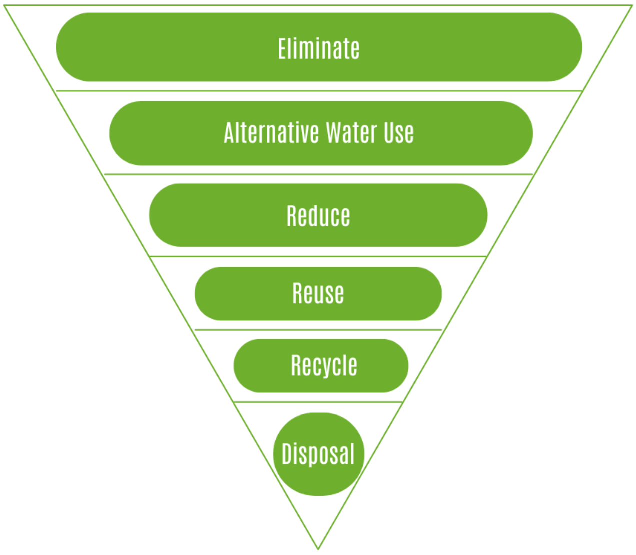
Managing water consumption in new development

England's water system is already under great pressure. According to the Environment Agency, the Anglian Water Company Area is under serious water stress. Future projections indicate that these challenges could be exacerbated by both population growth and the increased risk of droughts. Climate adaptation is critical to help us prepare for impacts like drought and water scarcity, which are projected to become more frequent and severe.

Key climate adaptation actions that can be taken to manage water consumption in new buildings relate to using water efficiently and harvesting/reusing water:

- **Install water-efficient fixtures**: These fixtures are designed to reduce water usage without significantly compromising performance. Fixtures include low-flow taps, showers, pressure-reducing valves and dual-flush toilets.
- **Smart irrigation systems**: These can be used in gardens to optimise watering frequencies and volume, thereby reducing overall water use.
- **Design in rainwater harvesting**: This involves the collection, typically from rooftops, and storage of rainwater for use. At its simplest, it involves connecting water butts to downpipes to capture water that can be used for gardening or other non-drinking uses e.g. washing cars and bikes.
- **Greywater recycling**: This is the collection and treatment of wastewater from showers, baths, sinks, and washing machines for reuse for non-drinking uses e.g. toilet flushing. Given a treatment system is required to prevent particles, bacteria and viruses from passing through to the next stage of the system, this can make greywater recycling a more complex and costly option.

Figure 1.5: The water management hierarchy



The water management hierarchy (Figure 1.5) provides a useful guide to good practice. It places water reduction above other measures, emphasising efficiency and largely passive measures (such as efficient water fittings).

While these measures will help manage water use in new developments, they could also be used to manage water use in existing developments. Notably, efficient water management has the potential to result in cost savings for residents/building occupiers.

The Town and Country Planning Association (TPCA) guide to building climate-resilient new communities provides further context for water efficiency in buildings.

Mitigating overheating risks

Increasing summer temperatures and heatwaves have the potential to impact occupants of buildings through overheating. 55% of homes in England already overheat during relatively cool summers.[12] Increasing temperatures exacerbate this risk, impacting occupants and potentially intensifying mould growth. Additionally, high temperatures can cause the expansion and contraction of materials, which can lead to cracks or damage.

Key actions that could be taken to mitigate the risk of overheating in new and existing buildings include:

- **Reduce solar gains**: Solar gain occurs when sunlight passes through windows and is absorbed by building surfaces. These can be reduced through:
  - shading.
  - window sizing.
  - window design.
  - taking account of a building's orientation and geographic location.
- **Trees, vegetation, and soft landscaping**: These can help regulate temperature through natural shading, thermal insulation and the release of water vapor into the atmosphere by plants.
- **Natural and mechanical ventilation**: Incorporating/maximising natural and mechanical ventilation will reduce the risk of occupants overheating in buildings. Natural ventilation (by opening windows or vents) should be prioritized over mechanical ventilation (such as air conditioning), as these involve energy use and therefore generate GHG emissions.
- **Building use and occupancy changes**: Accounting for seasonal climate changes in building use and occupancy through dynamic occupancy management can help manage internal heating loads, reducing the risk of overheating.

The following published guidance documents provide further context for minimising the risk of overheating in buildings:

[12] UKGBC, n.d. Climate Change Adaptation. https://ukgbc.org/our-work/climate-change-adaptation/

- Historic England's Technical guidance for improving climate resilience through adaptation.
- CIBSE's guidance on Preventing Overheating in Homes.
- TCPA's guide to building climate-resilient new communities.

A positive example

Carrowbreck Meadow is a development of 14 Passivhaus homes in Greater Norwich with a contemporary design of 'Norfolk style' local typology. The positioning and orientation of the homes maximise the access to solar gain in winter and prevent over heating in summer, and fresh filtered air is provided to the homes, utilising a heat recovery system. The buildings incorporate a thermal bridge and draught-free building envelope which exceeds regulations for airtightness and all homes have electric car charging points, rainwater butts and connection points for PV. The scheme has created comfortable healthy homes which are affordable to run, eliminating fuel poverty, future proofing these homes for the demands of our changing climate.