

# Greater Manchester Infrastructure Framework 2040

Energy, Transport, Water, Flood, Green+Blue, Digital







# 1 Executive Summary

Greater Manchester has experienced major change over the past decades, and this is anticipated to continue, if not accelerate, in the future – particularly as a result of population and employment growth, environmental & climate change and technological advances. All of these changes have the potential to impact on Greater Manchester's infrastructure, which supports the residents, communities, environment and local economy of the City Region.

Recognising the importance of our infrastructure and the multiple parties which are involved in its management and delivery, Greater Manchester Combined Authority (GMCA) have taken steps towards the delivery of a holistic, cross-sector Greater Manchester Infrastructure Strategy (GMIS). The aim being to focus on developing infrastructure which ultimately improves the lives of all those living and working within Greater Manchester.

This document – The Greater Manchester Infrastructure Framework - is a precursor to the GMIS. It looks to frame the key issues and priorities which the GMIS should address and sets out:

- The key trends affecting infrastructure up to 2040
- How those trends will affect each infrastructure network (i.e. the impacts)
- The response needed to achieve the Greater Manchester infrastructure vision – the Framework

The infrastructure sectors covered within this Framework focuses on the physical infrastructure broadly in line with the National Infrastructure Commission of:



**Energy**



**Flooding, surface and waste water management**



**Transport**



**Green and blue infrastructure**



**Digital**



**Potable (drinking) water**

While this Framework has focussed on the physical infrastructure, a separate study has been commissioned by GMCA to investigate a clearer mechanism to plan and deliver social infrastructure (including education, childcare, health and social care, and leisure and cultural facilities).

**“The infrastructure we have now, and the infrastructure we plan to build, will support and sustain us for decades to come. Our quality of life, and our success as an economy in the future, will depend on our infrastructure’s ability to respond to future challenges.”**

(NIC, National Infrastructure Assessment, 2018)

## Vision for the Greater Manchester Infrastructure Strategy:

Develop and maintain a holistic infrastructure system that is robust, accommodates sustainable growth and support the ambitions of the Greater Manchester Strategy to make ‘Greater Manchester one of the best places in the world to grow up get on and grow old’

## Key Trends to 2040

Ever improving efficiencies of buildings and appliances, and increased awareness and changing behaviour of consumers is reducing per capita demands.

### Population and Employment

- Population, housing and employment growth
- Changing working and shopping patterns
- Changing demographics – aging population
- Changing behaviours – conscious consumers
- Urban densification and regeneration

### The Environment and Climate Change




- A changing climate and decarbonisation
- The UK Government’s 25 year Environmental Plan
- Increasing recognition of the value of the environment to the economy and social well-being
- Legislation and the importance of improving air quality
- Increasing efficiencies of appliances and behavioural change
- Water Framework Directive & Water Quality targets

### Technological, Digitisation and Wider Changes

- Increasing digitalisation
- New technologies, artificial intelligence and automation
- Increasing use of smart technologies and environments
- Ultra-low emissions vehicles

## Impacts on the Future of Greater Manchester's Infrastructure Demands and Key Challenges

The key trends will have varying impacts on Greater Manchester's infrastructure over the coming decades up to 2040. The consequences of these impacts are summarised below and these have informed the development of a series of Key Challenges for GM's infrastructure that need to be addressed.

Heat	
<p>Housing and employment growth and the effects of extreme winter weather will increase the heat demand by approximately 15%.</p> <p>At present natural gas (a fossil fuel) provides 96% of primary heating fuel for homes. With the drive to decarbonise, GM will need to develop infrastructure capable of delivering low or zero carbon heat.</p>	 <p><b>Key Challenge 1: Low Carbon Heat</b></p>
<p>Delivering low or zero-carbon heat is likely to be expensive, as such, heat demand needs to be substantial reduced.</p>	 <p><b>Key Challenge 2: Retrofit</b></p>
Electricity	
<p>Housing and employment growth will increase the peak electrical demand. Electric vehicles may raise this by a similar increase as all of the projected housing and employment growth.</p> <p>If the response to delivering low/zero-carbon heat (Key Challenge 1) involves the electrification of heat this has the potential to produce a step change in peak electrical demand.</p> <p>The anticipated growth in renewable generation to move to a low carbon future will create more complex and unpredictable electrical supply patterns.</p> <p>The electrical infrastructure needs to be able to accommodate these changes. This will necessitate a change in the way the electrical infrastructure operates and is used. An alternative approach, to existing, must be taken to mitigate substantial reinforcement and expansion.</p>	 <p><b>Key Challenge 3: Changing demands on the electrical</b></p>

## Transport



TfGM forecasts an increase of more than 800,000 trips per day by 2040, largely as result of employment and population growth. Further changes in travel patterns will occur due to demographic changes (aging population), changing working practices and the prominence of online retail. These changes have the potential to increase congestion and delays across all modes of transport without further action.



**Key Challenge 4: Capacity, connectivity and diversity of transport networks**

Improving air quality and the move towards decarbonisation will require a shift to ultra-low emission forms of transport. Greater Manchester requires the associated infrastructure to support this change.



**Key Challenge 5: Ultra-low emissions vehicles**

## Potable Water



Despite population and employment growth, there is expected to be an overall reduction in potable water demand in Greater Manchester. This is due to on-going leakage reduction management by UU, increasing efficiencies of appliances and behavioural change of consumers. It is noted, that there will still be local pinch points associated with limitations of existing assets.

No key challenge has been identified as it is recognised United Utilities are leading on the aspects highlighted above through existing funding mechanisms.

**No key challenge for GMCA**

## Surface water, flood alleviation and waste water



The triple challenges of population growth, new development and climate change will mean the performance of Greater Manchester's drainage and sewerage systems and flood defences may fall below standard.

There will need to be a shift towards more nature-based solutions and additional investment to ensure Greater Manchester is fully resilient to future changes.



**Key Challenge 6: Mitigating flood risk**



## Green and Blue Infrastructure



Housing and employment growth and further infrastructure requirements (e.g. low/zero carbon energy generation) will place pressures of GM's blue and green infrastructure.

There is increasing recognition and economic evaluation of the importance of green and blue infrastructure to our economy, health and social well-being. The increasing use of approaches which help to account for, protect or enhance our environment (e.g. Natural Capital and Environmental Net Gain) will help to progressively improve the region's green and blue infrastructure.

Notably, green and blue infrastructure has no direct funding stream, often presenting long-term uncertainty in driving forward the agenda.



**Key Challenge 7: Maximising the eco-systems services provided by green and blue**

## Digital



Digital technology is increasingly the backbone of the major industries and our daily lives.

Approaching 2040, GM will need to be a smart and digitally ready City Region. To achieve this, and support on-going digitalisation, the region will require resilient fixed connectivity (through full fibre) supported by 5G (and subsequent technologies).



**Key Challenge 8: Pervasive, affordable, resilient digital connectivity**

## Cross Sector

Infrastructure within Greater Manchester (and across the wider UK) is owned and managed by a multitude of organisations/providers. GMCA and the Local Authorities have limited direct control over infrastructure provision or decision-making processes within these sectors. Challenges arise due to co-ordination and responding to change outside of infrastructure sectors regulatory investment cycles.

Notably, green and blue infrastructure has no direct funding stream, often presenting long-term uncertainty in driving forward the agenda.

Ensuring the security of supply throughout each day against challenges associated with ageing assets and 'shocks' (e.g. flooding) and 'stresses' (e.g. population growth).



**Key Challenge 9: Collaboration**



**Key Challenge 10: Funding**



**Key Challenge 11: Resilience**

## The Framework

The Framework for Greater Manchester:

- Identifies the responses required by GMCA, the Local Authorities and other stakeholders to address the key challenges
- Identifies opportunities for collaborative working to ensure GM is ready for, and can capitalise on, anticipated changes
- Positions Greater Manchester at the forefront of a changing dynamic of infrastructure use

The framework contained within the main body of the report identifies where relevant projects and programmes are already underway or planned and then subsequently where additional initiatives are required.

### Key Challenge 1: Greater Manchester needs infrastructure capable of delivering low/zero carbon heat

- 1A** - Engage with work to assess the viability of 100% hydrogen replacement of natural gas in the existing gas network
- 1B** - Document the wide-scale applicability of options for delivery of electrical heating by heat pumps across GM's existing domestic and non-domestic properties
- 1C** - Continue scenario planning to determine the future balance of low/zero carbon heat between either hydrogen, electrified heat, district heating and other forms

### Key Challenge 2: There needs to be a substantial programme of reduction in demand from existing and new buildings

- 2A** – Significantly reduce the heat demand of existing buildings
- 2B** – Significantly reduce the heat demand of new buildings

### Key Challenge 3: The current electrical infrastructure needs to be able to accommodate the growth of local renewable generation, rapid electric vehicle charging and, potentially, the electrification of heat

- 3A** – Understand the opportunities and implications of a changing electricity distribution network and its regulatory framework
- 3B** – Provide greater definition of the scale and type of local generation needed to meet a zero carbon future, and the technologies required to facilitate its integration and demand management
- 3C** - Determine GM's Electric Vehicle charging electrical demand
- 3D** - Determine GM's potential future rise in electricity demand from electrification of heat

### Key Challenge 4: Greater Manchester's transport infrastructure networks should provide the capacity, connectivity and diversity to meet the future needs of its residents

- 4A** – Enhance the attractiveness and capacity of walking, cycling and public transport within GM.

### Key Challenge 5: Greater Manchester needs the infrastructure to support ultra-low emissions vehicles

- 5A** - Determine Greater Manchester's role in setting the future for electric vehicle charging and hydrogen re-fuelling
- 5B** - Determine the locations, scale and phasing of the key hydrogen demands for high torque transport (buses, HGVs etc.)
- 5C** - Understand the travel and work patterns associated with electric vehicle charging to determine the location and capacity of the electrical infrastructure required

### Key Challenge 6: Provision of infrastructure that maintains and/or reduces flood risk across Greater Manchester whilst accommodating developmental growth and climate change

- 6A** – Develop a robust funding strategy to provide flood risk infrastructure to support anticipated growth
- 6B** – Understand the implications for GM of potential future changes in the appropriate standards of protection against flooding
- 6C** – Complete actions from the GM Draft Level 1 Strategic Flood Risk Assessment

### Challenge 7: Maximising the eco-systems services provided by green and blue infrastructure, whilst responding to spatial pressures on finite space and improving accessibility

- 7A** – Enable an economic value to be placed on green and blue infrastructure
- 7B** – Implement an environmental net-gain approach
- 7C** – Continue to enable further schemes to increase the green and blue infrastructure schemes in GM

### Key Challenge 8: Implementation of the GM Digital Strategy to provide pervasive, affordable, resilient digital connectivity

- 8A** – Ensure the digital leadership in GM remains relevant and tailored to the continually changing needs whilst driving uptake by consumers
- 8B** – Influence the development of digital infrastructure regulation to enhance alignment with GM interests.
- 8C** – Streamline the process for installation of new infrastructure within the street-space



### **Key Challenge 9: Greater Manchester's infrastructure needs a collaborative and co-ordinated approach to meet the present and future needs of the region**

**9A** – Determine the process to address future changes and challenges through the production of a GM Infrastructure Strategy

**9B** – Enable sharing of programmes, plans and projects between GMCA, the infrastructure providers and the ten districts and identification of collaborative funding opportunities

**9C** – Provide the capacity of GMCA, the districts and the infrastructure providers to enable the above

### **Key Challenge 10: Funding models are needed to meet the present needs and enable change for the future**

**10A** – Evaluate and articulate the total benefits of investment in infrastructure

**10B** – Drive scheme agglomeration and long-term certainty

**10C** – Identify alternative funding models that enable transformative funding, and partnership working amongst the GM infrastructure stakeholders

### **Key Challenge 11: Infrastructure that is resilient to shocks and stresses**

**11A** – Improve the understanding of the reliance of GM on resilience of its infrastructure networks, and based in this understanding deliver improvements in their individual and collective resilience

Building on the framework for Greater Manchester (above), and in recognition of the development of the Greater Manchester Spatial Framework (GMSF), the document considers three typical spatial typologies within Greater Manchester (i.e. the Regional Centre, Towns and New hubs of development) and identifies the different nature of the responses required beyond those identified in the overarching framework. Please refer to the main body of the document for further information.

**Next steps: The newly defined Greater Manchester Strategic Infrastructure Board will focus on taking the GMIF forward and support the delivery of the GMIS.**



# **The UK Government has recognised the complexity and importance of our infrastructure in ‘transforming the UK economy’ and ‘shaping our lives’**

(HM Gov, National Industrial Strategy, 2017)

(HM Gov, National Infrastructure Delivery Plan, 2016-2021)

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# Greater Manchester's Infrastructure Challenge

**The Greater Manchester (GM) City Region is comprised of ten district councils (Bolton, Bury, Manchester, Oldham, Rochdale, Salford, Stockport, Tameside, Trafford and Wigan). Greater Manchester is home to 2.8 million people, and with a GVA<sup>1</sup> of £56 billion, Greater Manchester represents the largest functional economic area outside of London<sup>2</sup>, accounting for 40% of GVA in the North West<sup>3</sup>.**

The UK Government has recognised the importance of infrastructure and established the National Infrastructure Commission (NIC) in 2015. The NIC has recently completed their first National Infrastructure Assessment (July 2018) which identifies, at a national level, how the infrastructure needs and priorities of the country should be addressed.

The National Industrial Strategy (June 2018) has further defined infrastructure as one of the five 'foundations of productivity'<sup>4</sup> and recognises its importance in 'transforming the UK economy'.

With recognition to the above, the Greater Manchester Strategy (GMS) highlights the importance of infrastructure to ensuring 'a thriving and productive economy in all parts of Greater Manchester'<sup>5</sup>.

Greater Manchester has seen major change over the past decades and this is only expected to continue, if not accelerate further, in the future. GM's population and employment patterns are expected to change which, along with considerable environmental (including climate change) and technological changes, have the potential to significantly affect our infrastructure networks. These changes must be successfully managed to achieve the best outcomes for Greater Manchester.

Physical infrastructure is owned and managed by a wide range of organisations, at local and national levels. Each type of infrastructure depends upon each other and these interconnections play a critical role in the provision of effective infrastructure that supports the populace. The management of these systems, and their interconnections, can make it difficult for infrastructure to respond to change - running the risk of infrastructure hampering, not contributing to GM's future.

It is for these reasons that the Greater Manchester Combined Authority (GMCA) has undertaken work towards a holistic, cross-sector Greater Manchester Infrastructure Strategy (GMIS), with the aim being to ensuring our infrastructure does not become a barrier to economic growth and impact on the environment and lives of the communities living and working in Greater Manchester.

The GMIS will set out the strategic directions for the short, medium and long-term priorities for infrastructure across Greater Manchester up to 2040, whilst facilitating further collaboration with the infrastructure providers, GMCA and Local Authorities within Greater Manchester.

Greater Manchester has many great infrastructure attributes, however future challenges facing the region will mean that Greater Manchester and its partners will need to work collaboratively to achieve the City Region's vision of world-class infrastructure to support its residents and businesses.

1. Gross Added Value – i.e. a measure of the values of goods and services produced in an area, industry or sector of an economy. For example, £56 billion of real value produced in the economy, like national GDP.

2. GMCA - Urban Pioneer Strategic Plan (2017)

3. New Economy – Greater Manchester Key Facts (2017)

4. GMCA - GMS Implementation Plan (2017)

5. HM Government – National Industrial Strategy (2017)

## An Infrastructure Strategy

The need for the Infrastructure Strategy and its underlying Vision are set out in the Greater Manchester Strategy (GMS). The GMS is a people and place centric ambition to create a 'more inclusive and productive city region' which ensures that all the communities of Greater Manchester can 'benefit from economic growth and the (associated) opportunities'. To achieve this vision the GMS is structured around ten priorities for Greater Manchester, which the Greater Manchester Infrastructure Strategy will draw upon.

The Infrastructure Strategy will establish the potential high-level approach to enabling the future for Greater Manchester's infrastructure, and is to act as a bridging document to tie together the various relevant infrastructure sectors and Greater Manchester strategies towards the collective aims and canvas of change in Greater Manchester.

Key ambitions for the Greater Manchester Infrastructure Strategy are outlined below and seek to respond to the overarching Greater Manchester Strategy, with a focus on developing infrastructure which ultimately improves the lives of all those living within Greater Manchester:

### The Greater Manchester Infrastructure should seek to...

- Supports the lives and well-being of the people, communities and the environment within Greater Manchester
- Be age-friendly and support the economic and social participation of both young and old
- Support strategically identified growth for parts and communities within Greater Manchester
- Be flexible, robust and meet the existing and future needs of the communities and technological change
- Provide world-class connections and access to opportunity for all
- Provide world-class digital infrastructure which provides the platform for Greater Manchester to embrace emerging technological and societal changes
- Support a carbon-neutral Greater Manchester and be economically, environmentally and socially sustainable
- Protect and enhance the environment and associated social benefits to all the communities of Greater Manchester

Vision for the Greater Manchester Infrastructure Strategy

**Develop and maintain a holistic infrastructure system that is robust, accommodates sustainable growth and supports the ambitions of the Greater Manchester Strategy to make 'Greater Manchester one of the best places in the world to grow up, get on and grow old'.**

**our  
people  
our  
place**

**The Greater Manchester Strategy**



# Let's make



1

Children starting school  
ready to learn



2

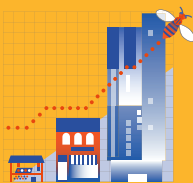
Young people  
equipped for life



3

Good jobs for people to  
progress and develop

## Greater Manchester



4

A thriving economy in  
Greater Manchester



5

World-class  
connectivity



6

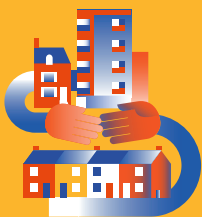
Safe, decent and  
affordable housing



7

A green city for all

## one of the best



8

Safe and strong  
communities



9

Healthy lives and  
quality care



10

An age-friendly  
Greater Manchester

## places in the world

# An Infrastructure Framework

This Greater Manchester Infrastructure Framework is a precursor to a Greater Manchester Infrastructure Strategy. It focuses on the physical infrastructures broadly in line with the National Infrastructure Commission of:

- Energy
- Transport
- Water and wastewater (drainage and sewerage)
- Flood risk management
- Digital communications

It looks to frame the key issues and priorities which the GMIS should seek to address, to frame the future dialogue with the Greater Manchester infrastructure providers and facilitate action. The Framework sets out:

- The key trends affecting infrastructure to 2040
- How those trends will affect each infrastructure network
- The response needed to achieve the Greater Manchester infrastructure vision

The setting for this infrastructure Framework as well as the vision and ambitions for the infrastructure strategy were developed through a preceding “Definition” stage. These were each developed in partnership with the infrastructure providers and stakeholders of GM.

The challenges identified within this Framework document were initially founded from ten key infrastructure challenges identified in conjunction with the infrastructure providers during the Definition stage. These have been developed further through the production of this Framework by further articulation of the future trends and evaluation of the impact that these will have on the infrastructure.

The scoping and framework stages to date have concentrated on physical infrastructure. However, a need has been identified by GMCA for a clearer mechanism to plan and deliver social infrastructure. In particular it's essential that the implications of forecast population change for the demand for education and childcare, health and social care and leisure and cultural facilities are fully understood.

The Combined Authority has initiated a project to review and establish at high level:

- Which organisations hold responsibility for the provision of social infrastructure across Greater Manchester.
- The status of the social infrastructure pipeline and how new social infrastructure planning is linked to development plans.
- On what information and by what methodology is social infrastructure specified and planned.
- What barriers and impediments are anticipated to the delivery of this infrastructure.
- Whether any further support at combined authority level could secure and improve the delivery of this pipeline.

- The project is building upon the wealth of positive activity already underway across Greater Manchester led by the following groups and officers networks:
- Existing social infrastructure planning undertaken by the 10 districts
- Land commission and One Public Estate programme
- Greater Manchester Directors of Children's Services Group
- GreaterSport and GM Moving
- Health and Social Care partnership
- Culture Strategy / Culture and Heritage Steering group for Greater Manchester
- Social housing consideration through the Strategic Housing Group

## **This Framework sets out “what” is the future for infrastructure needs; the Strategy will then develop “how” this should be achieved.**

In developing this Framework it has been recognised that predictions of infrastructure demand and networks in 2040 is subject to large uncertainties. To ensure that the Framework draws on the best estimates of that uncertain future, it has been developed in consultation with the following Partners and Infrastructure Providers. It has been based on evidence of likely trends and changes in demand and supply collected from a range of sources, including:

- National Infrastructure Assessment, and seeks to bring these projections together on a consistent basis.
- GMCA – including Urban Pioneer & Digital
- TfGM
- SCATTER research – Tyndall Centre, Manchester
- Electricity North West Limited (ENWL)
- United Utilities
- Environment Agency (EA)
- BT Openreach
- Cadent
- Highways England
- Homes England

# Key Trends to 2040

The Greater Manchester Infrastructure Strategy looks to consider the time period up to 2040.

This following section identifies the key trends that will affect our infrastructure to 2040. A commentary is provided on how these trends will change the demand on the infrastructure. It also highlights the interconnections and interdependencies of these changes through the various forms of infrastructure.

Transport to the year 2040 is already extensively covered within the Greater Manchester Transport Strategy 2040

and, therefore, only those aspects and key issues that are pertinent to the other forms of physical infrastructure and their interdependency are drawn out within this document. The trends have been grouped within the three following areas:

- Population and economic growth, including demographics and social change
- The environment and climate change
- Technological, digitisation and wider changes

The infrastructure covered has been grouped into the following six areas and are considered within Greater Manchester (from the point of view of supply, distribution and use). Where the trend has an impact on a particular type of infrastructure this is indicated via the icons shown below. The impacts on the infrastructure are explained in the subsequent section.



## Energy

*Electricity North West (ENWL)*  
*Cadent (Gas)*

Electricity and heat generation, distribution and storage.



## Transport

*Transport for Greater Manchester (TfGM)*  
*The 10 districts of Greater Manchester*  
*Highways England*  
*Network Rail*  
*Bus Companies*  
*Train Operating Companies*  
*Manchester Airport Group (MAG)*

Walking, cycling, Metrolink, heavy rail, roads, airports, ports and waterways, for both passengers and freight.



## Potable (drinking) water

*United Utilities (UU)*  
Sourcing and delivery of clean water supplies.



## Digital

*Telecommunications Operators*  
Passive infrastructure – i.e. duct provision, fibre, Wi-Fi and mobile infrastructure. (Excludes active networking equipment, data storage and server provision.)



## Flooding, surface and waste water management

*Environment Agency (EA)*  
*United Utilities (UU)*  
*GMCA & Local Authorities*  
*Private Landowners*

Infrastructure supporting the mitigation and alleviation of flooding and the collection, conveyance, management and treatment of surface and waste water; such as drainage pipes and waste water treatment works (WwTW).



## Green and blue infrastructure

*GMCA & Local Authorities*  
*Private Landowners*  
*Local Residents and Businesses*

Green and blue infrastructure refers to the green and blue spaces and nature based features within and between urban areas in Greater Manchester, such as parks, river valleys, gardens etc. Natural capital identifies and places a value upon these assets within an ecosystem, such as forests, soil and living things.



# Population and Employment

## Population and employment growth

The Greater Manchester Spatial Framework is a joint plan for Greater Manchester that will provide the land for the projected numbers of jobs and new homes across the city region.

The employment and housing numbers behind this are set out by the Office for National Statistics, which indicates the population will grow by 275,245 between 2016 and 2040, driven mostly by natural increase (birth rates and residents living longer). Total employment is forecast in GMFM (2018) as:

- GMFM-2018 shows GVA growing at 1.7 % per year up to 2036, the same headline rate of growth shown in the previous GMFM-2017 model.
- Productivity is forecast to grow at 1.3% per annum, (0.1% per year more than GMFM-2017), reflecting slightly better outturn in productivity data from ONS during 2017/18.
- Total employment is forecast to grow at 0.5% per year in GM, equating to a net increase of 140,100 employees 2016 to 2036, compared to 141,000 in the previous model.
- Employment growth is largely driven by Business, Financial, and Professional Services - accounting for over half of the net increase in jobs up to 2036



More people will mean more homes and business and more consumers of energy.



More trips on the transport network.



Increased demands on the potable water supply and the quality of water resources.



Increasing levels of urban development will increase the proportion of hard surfaces and surface water run-off volume. More people may choose to live in existing homes at risk of flooding.



Population growth could lead to a reduction in the area of GM's green and blue infrastructure, replaced with new homes and business, whilst the additional population will lead to more people looking to use those resources.



More people will mean more homes and businesses, and more consumers of digital services.

## Changing working and shopping patterns

Shopping patterns are increasingly moving online, whilst flexible working will become more prevalent.



Changing personal and business behaviours will impact on peak energy demand and consumption.



Changing freight and logistics requirements



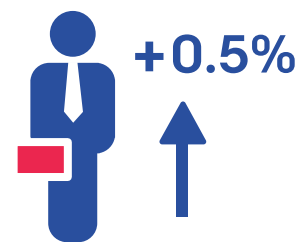
A growing demand for high speed, resilient data connectivity to facilitate these changing patterns



**+ 275,245**

2016 → 2040

**Population will grow by approximately 275,245 between 2016 and 2040**



**Employment is forecast to grow at 0.5% per annum in GM, equating to a net increase of 141,000 employees**

## A changing workforce

A more productive, higher skilled workforce, in higher paid jobs, focusing on more specialised and skill activities.



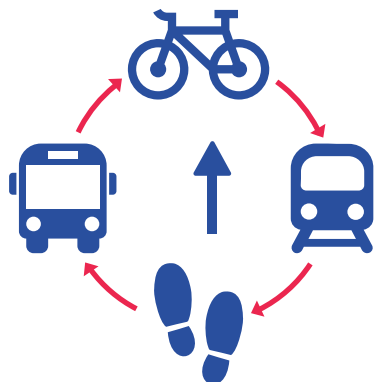
Tends to lead to increased commuting distances and more complex travel patterns.



Digital infrastructure to support the higher skilled industries – these may require increased digital infrastructure with energy demands associated



People aged over 70 predicted to increase by 15.2% by 2021



Improved transport connectivity

## Aging population

In the UK, the proportion of the population aged 65 and older is projected to increase from 18% in 2015 to 25% by 2045. Our population in Greater Manchester is aging, and people aged over 70 predicted to increase by 15.2% by 2021, with the trend looking to continue to 2040.

(GMCA, Greater Manchester Population Health Plan 2017-2021)



Changing demographics will change energy demand requirements, e.g. increased heating or cooling demands to achieve comfort levels for vulnerable residents.



There will be an increased need for accessible transport infrastructure, with additional travel demands due to more people working later in life.



Providing accessible, high quality green and blue spaces will become increasingly important in maintaining the mental and physical well-being of the elderly.

## More conscious consumers

Research suggests that beyond 2020, a new 'conscious consumer' will begin to dominate demographics (OECD, 2012), who have a focus on healthier, more sustainable and social lifestyles.



Greater demand for sustainable and active travel routes across Greater Manchester.



Residents will have a greater demand for higher quality green and blue infrastructure.

## Urban Densification and Regeneration

The density of our urban centres will increase along with a projected growth of residents in these areas.



Greater density in our urban centers will create areas of locally increased energy demand.



Increased density in urban areas could contribute to reduced trip lengths and reduced car dependence due to greater accessibility of public transport services within urban areas and promote more use of walking and cycling.

Over 100,000 people lived in the Regional Centre in 2011, marking growth of 120% over the previous decade. There are now around 11,000 new residential units under construction in Central Manchester and Salford. The population is highly mobile - in 2010, 32,000 people moved to live in the Regional Centre, with 26,000 of those coming from the rest of the UK

# The Environment and Climate Change

## Climate Change

Climate change will alter weather patterns and increase the frequency and severity of extreme events, including higher seasonal rainfall and hotter summers.



More frequent 'Dry periods' increase our consumption of water and its availability when we need it most leading to increased chances of drought.



Increased probability and risk of flooding will lead to greater impacts on our infrastructure and higher standards of protection being required.

Heavier rainfall will lead to increased pressures on the surface and waste water networks. This will include impact on bathing water quality from effluent entering watercourses via CSOs and agricultural run-off due to increasing rainfall.



More green and blue infrastructure will be required to help mitigate climate change – such as flooding and urban heat island effect.

## Increasing recognition of the value of the environment to the economy and social wellbeing

There is a growing awareness, backed by on-going research, that increasingly recognises the social, environmental and economic benefits that nature can deliver in creating liveable cities - overseen by the Natural Capital Group as part of GMCA.



The use of natural capital as a tool, with a more green and blue infrastructure led design approach, should become common-place in key choices and decision making, to give due regard to the environment as an asset to the overall economy.



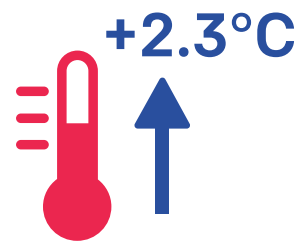
Current planning approach is one of no net environmental loss; this needs to shift to an 'environmental net gain' principle for development, including housing and infrastructure, with an aim to safeguard and enhance our green and blue infrastructure.

### Major Project: Urban Pioneer

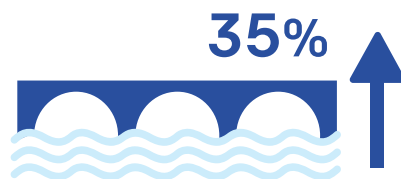
Greater Manchester is one of four cities nominated to help achieve the aims of the Government's 25 Year Environmental Plan (25YEP), through the application of Natural Capital. The Pioneers will identify good practice and innovative solutions to current environmental challenges.



**Overall peak rainfall intensity is expected to increase by up to 20% by 2040**  
(UK Government)



**Annual temperature rise by 2050**  
(EcoCities, 2011)



**The costs of the December 2015, Storm Eva, flooding event in GM are estimated to be £5-5.8 billion (KPMG). Extreme winter rainfall, like that experienced in December 2015, is now thought to be 7 times more likely as a result of human emissions of greenhouse gasses.'**

(EA, 2016).





**UK Greenhouse gas emissions to be reduced by at least 80% by 2050**  
(Climate Change Act 2008)

**Greater Manchester total tree cover is at 17% (City of Trees).**



Liverpool —————> Hull

### Major Project: Northern Forest

Plans are underway to create a new Northern Forest with 50million new trees, shadowing the path of the M62 from Liverpool to Hull, and encompassing Greater Manchester. The forest will look to improve the local environment, air quality, human health, flood risk and support tourism and recreation activities.

### Major Project: City of Trees

The City of Trees movement has a target to plant at least 3 million trees in Greater Manchester over the next 25 years as well as bringing existing woodlands into management.

## Air Quality

TfGM has developed the Greater Manchester Low-Emission Strategy and Greater Manchester Air Quality Action Plan, concentrating on ways to tackle emissions from road transport to improve air quality and to help in reducing carbon dioxide emissions. These complement the Greater Manchester Climate Change and Low Emissions Implementation Plan, which focuses on making the most of the region's energy and resources through reducing its carbon footprint.



Ultra-low emissions vehicles are likely to be an essential component in the solution.



The use and presence of green and blue infrastructure will be come increasingly important in improving air quality in Greater Manchester.

## Decarbonisation

The UK is committed (Climate Change Act 2008) to reducing its greenhouse gas emissions by at least 80% by 2050, relative to 1990 levels. Greater Manchester is moving towards ambitions to achieve net zero carbon by 2038, in support of its understanding of the likely implications for cities in the UK of the Paris Agreement 2015.



Our power, heating, cooling and transport sectors will have to move towards being zero carbon.



There needs to be a full-scale shift away from traditional combustion engines with a transition to electric, hybrid or hydrogen vehicles.



Location of land available for new energy infrastructure, particularly associated with decarbonisation efforts – e.g. solar panels, bio-fuels, storage etc. raising a tension between zero carbon energy and green & blue infrastructure.

**SCATTER modelled scenario for PV provision in GM:  
'16m2 per household on 50% of all households in GM. A residual 5.5-16.8km2 required on commercial rooftops or on ground mounted installations. 3.4-6.0TWh/year (7-12%) of GM energy demand.'**

# The Environment and Climate Change

## Efficiency

Ever improving efficiencies of buildings and appliances, and increased awareness and changing behaviour of consumers is reducing per capita demands.



Increased efficiencies of fittings and changing behaviours will reduce the demand on the infrastructure.



The use of smarter technologies within each infrastructure sector will look to improve efficiencies further.



**20 -40%**

of energy in existing buildings can be profitably conserved.

Passive building standards are at or near profitability for most new-build segments, but still only constitute a minority of buildings.

Arup, First Steps Towards a Circular Built Economy (2018)



**Approx 60% of residential demands are from appliances. (National Grid Future Energy Scenarios)**

**EU 2030 target for electrical appliance efficiency saving of 30%**



**+ 5-30%**

**Commercial appliances improve in energy efficiency by 5-30%**

SCATTER scenario planning (2018)

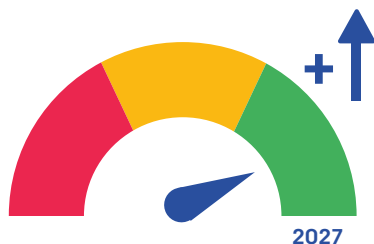
**Areas of social and economic deprivation, which are often linked to with poorer health and reduced life expectancy, can also be associated to limited access to good quality green space.**

(Arup, Cities Alive, 2015)



**Urban greening as an asset has enormous potential to improve our health and wellbeing.**

(Arup, Cities Alive, 2015)



**The Water Framework Directive aims to ensure that all water bodies reach "good status" by 2027.**

## **The UK Government's 25 year environmental plan**

'A Green Future: Our 25 Year Plan to Improve the Environment', sets out what the UK will do to improve the environment, within a generation.



By 2040, the ambition of the government's plan is to achieve high quality, accessible, natural spaces with increased bio-diversity close to where people live and work; with a focus around the equal distribution of environmental benefits and resources to all. Including restoration of freshwater protected sites and wildlife habitats and an increase in woodland cover.



Meeting the aspirations of the plan will necessitate improved water quality of outflow from Greater Manchester's waste and surface water management infrastructure and a shift away from traditional 'hard' engineered solutions

## **Water Framework Directive & Water Quality**

The Water Framework Directive (WFD) covers all European water bodies, and was transposed into English Law by the Water Environment Regulations (2003). It aims to ensure that all water bodies reach "good status" by 2027.



A majority of waterbodies in GM (>70%) bear little resemblance to their natural state i.e. they been heavily modified over the previous decades (EA, 2018). Over 90% of water bodies in GM are failing their objectives under the WFD, with most classified as 'moderate' status.

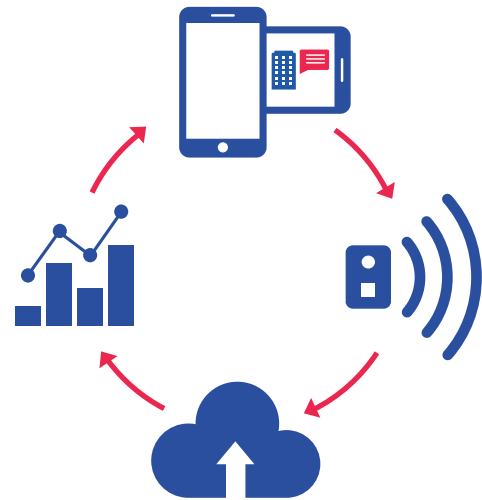




# Technological, Digitisation and Wider Changes

## Digitalisation

We are living in an increasingly digital world. Over the last ten years, technologies that are visionary today rapidly become part of everyday life tomorrow. In turn, people's expectations are rising constantly. 'Digital' now encompasses an increasing array of technologies, from sensors, smartphones, and robots, to augmented reality, cloud computing and data analytics. These technologies are changing the way we live and places we live in. Digital technologies are being used to make cities more smooth running, more productive, and more democratic. The pervasiveness of digital technology in our lives represents a major change. For these technologies to function effectively, it is fundamental that a robust and diverse underpinning infrastructure is installed that ensures a futureproofed platform for the development of these – and many new technologies – for years to come. As our homes, businesses and cities become more reliant on digital technology to function the robustness of those systems becomes even more critical.



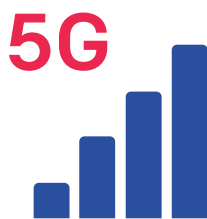
**Digital technologies are being used to make cities more smooth running. eg. sensors, smartphones, augmented reality, cloud computing and data analytics.**



Consumers will become increasingly reliant on electricity, as systems become 'smarter' and more technology enters daily lives.



Anyone in Greater Manchester should be able to access resilient, seamless connectivity at a speed they need anywhere at anytime.



**Future digital infrastructure will need to be supported by 5G (and beyond)**



**Consumers will become increasingly reliant on electricity, as systems become 'smarter'.**

## New technologies, artificial Intelligence and automisation

Improvements in artificial intelligence and automisation technologies will transform infrastructure sectors and business markets.



Blockchain technology may play a role in trading of energy – such as peer to peer tariffs.



Autonomous vehicles are expected be present within Greater Manchester by 2021.



Digital infrastructure will be crucial to supporting future technology and a Smart City Region.

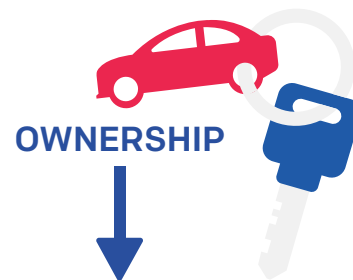


A growth of autonomous vehicles may enable the reduction of car parking space within urban area. There is an opportunity to utilise this emerging space for green infrastructure.



**Autonomous vehicles are expected be present within Greater Manchester by 2021.**

**The Chancellor of the Exchequer, Philip Hammond, set an objective for driverless vehicles without a safety attendant to be on the UK's roads by 2021 (2017)**



**Improving the economics of shared use will cause a shift away from individual vehicle ownership.**

(Commission of travel demand, 2018).

# Technological, Digitisation and Wider Changes

## Smart environments

New technologies will facilitate the creation of smart environments. Homes, networks and environments will become smarter, thanks to smarter devices connected by the Internet of Things and the fitting of smart meters and appliances within every house within GM. GM's urban and other significant economic centres will have smart grids.



Mobility as a Service (MaaS) – i.e. a single integrated system of payment/access for all modes of transport and extensively used within GM by 2040. MaaS with connected smart devices could allow services to evolve as they are accessed – enhancing delivery and creating a smart network.



Enhanced decision making - reducing demands and improve efficiency in Greater Manchester. Data from smart meters in particular will allow:

- Better insight into consumer patterns
- Better targeting / early anticipation of leakages and issues
- Intelligent demand management within the network

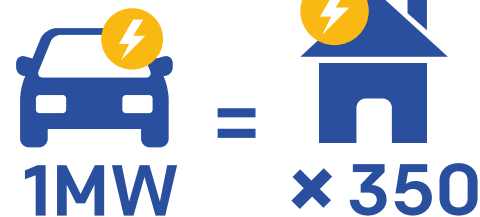


Technology will facilitate the development of a 'Smart Environment', with the ability to understand water quality in real-time, support decision making and collate data to support new 'value' models for water.



**A single integrated system of payment/access for all modes of transport, will be extensively used within GM by 2040.**

**Emerging super-fast charge rate**



**Emerging fast charging technologies can create a peak demand of 1MW - equivalent to the average demand of approximately 350 homes**

## Ultra-low Emissions Vehicles

The UK government recently announced ambitions for 50-70% of new cars and 40% of vans to be ultra low emission by 2030 and that the sale of new petrol and diesel vehicles will be banned in the UK from 2040. SCATTER research suggests Greater Manchester will need to transition to 80-100% electric, hybrid or hydrogen vehicles (including cars, trucks, buses and rail) by 2040 to achieve its emissions targets.



Provision of charging, re-fuelling and parking infrastructure will be required to facilitate this transition.

**The electricity required to travel 80 miles is equivalent to the daily consumption of an average house**

(ENWL, 2015-2023 Well Justified Business Plan (2017))




**2040**

**The Government will end the sale of new conventional petrol and diesel cars and vans by 2040**

(The Road to Zero, Department for Transport, 2018)





**“ Being among the first to fully embrace new green [electric vehicle] technologies has the potential to bring huge economic advantages, and Greater Manchester is primed and ready to take that step. The automotive industry is hugely important for jobs in the UK, and the next generation of ultra-low emission vehicles will provide huge opportunities for our digital and manufacturing sectors.”**

**(Andy Burnham, 2018)**



# Impact on the Future of Greater Manchester's Infrastructure Demands

## Impacts

The trends described in the preceding section will have varying impacts on Greater Manchester's infrastructure over the decades up to 2040; this section outlines what those impacts could be on each of the infrastructure sectors:

- Electricity and Heat
- Transport
- Potable Water
- Surface water, flood alleviation and waste water
- Green and Blue Infrastructure
- Digital

Whilst the subsequent sections address each of the sectors individually there are also some cross sector issues which are also identified. It further provides high-level estimates of the resulting changes in demands for heat, electricity, transport and water across Greater Manchester. By exploring the impacts on GM's infrastructure, a series of Key Challenges are identified throughout the following sections. Some Key Challenges are cross sector, and these have also been identified. The Key Challenges have been founded upon the key infrastructure challenges developed in partnership with the infrastructure providers during the Definition stage of this report's development.

All these Key Challenges are then drawn together to develop a Framework for Greater Manchester's infrastructure, which sets out the actions required in response to these Challenges. This Framework is outlined later in the document.

Where it has been possible to estimate the quantum of the impacts by 2040, this has been drawn from existing information sources and discussions with infrastructure providers. They are provided at a City Region level and should not be used to estimate the impact of the trends at a specific site or district.

The future impacts have been reviewed at a Greater Manchester regional scale. However, there will be localised capacity issues and opportunities within the region when considered at a smaller spatial resolution. The ten districts should work with GMCA and the infrastructure stakeholders to undertake work to understand key pinch-points and where opportunities around strong infrastructure capacity can be maximised.









# Heat

## Impact on the Future of GM's Heat Demand

Heat is a major energy demand generated in our domestic, commercial and industrial sectors and primarily fuelled by gas. Compared to heat, cooling demand is lower overall, but still significant; particularly from non-domestic sectors. The demand stems from refrigeration, air conditioning and other cooling devices and processes requiring electricity. town and city centres, and predominately supplied by the electricity network.

Heat and cooling demands are influenced by a range of factors. For example non-domestic heat demand is driven by changes in industrial processes, commercial and domestic heat demand often driven by a building's occupancy patterns as well as building design.

There are a number of key trends affecting Greater Manchester's heat demand to 2040:

## Population and employment growth

Heat demand could increase by 2040 as more buildings are built to meet a rising population and growth in employment. Current building insulation and energy standards are much higher than in previous years, so the increase in heat demand will be less than the pro-rata increase in population.

## Aging populations, changing working patterns and climate change

Peak demands across heat network are likely to change with demographic changes and our aging population for example increased heating or cooling demands to achieve comfort levels for vulnerable residents. Also more people working from home and longer office working hours could increase heat demands throughout the day. Climate change may contribute additional heating and cooling demands in response to extreme weather conditions.

**Manchester City Centre Civic Quarter and the Piccadilly area are developing proposals for district heat networks, to help GM move towards zero carbon heating**

## Decarbonisation

To achieve carbon neutrality targets, the heat sector will need to be totally transformed. At present natural gas (a fossil fuel) provides 96% of primary heating fuel for homes (Energy Technologies Institute, 2017), and this will need to be substantially reduced or eliminated by 2040.

There a series of options available to help transition towards a decarbonised heat sector. This is likely to include district heating in dense urban areas (with large consumers and estates under common ownerships) and the electrification of heat – e.g. electric heating, heat pumps, in new developments where connections to heat and cooling networks are not possible. Thermal storage could reduce peak heat demands, helping balancing load through the day.

Hydrogen and biogas could partially (or fully) replace natural gas for space heating. Pursuing a hydrogen future will necessitate the production of low/zero carbon hydrogen and the transition of the existing gas network and domestic and non-domestic gas boilers to hydrogen. Either route is currently more expensive than heating via natural gas.

The future route is currently very uncertain, but what is extremely likely is that there will need to be a major change in heating infrastructure to deliver low / zero carbon heating.



**Key Challenge 1: Greater Manchester needs infrastructure capable of delivering low/zero carbon heat**

Achieving a 40% heat reduction depends on the property type, age and existing state. It is considered such a reduction could be achieved (based on a Victorian era property) through retro-fitting properties with:

- New glazing and draught-proofing and air-tightness
- Loft insulation
- Solid wall insulation
- Mechanical Ventilation with Heat Recovery system
- New energy-efficient boiler and smart energy controls

(Salix, 2009 and Arup, 2016)



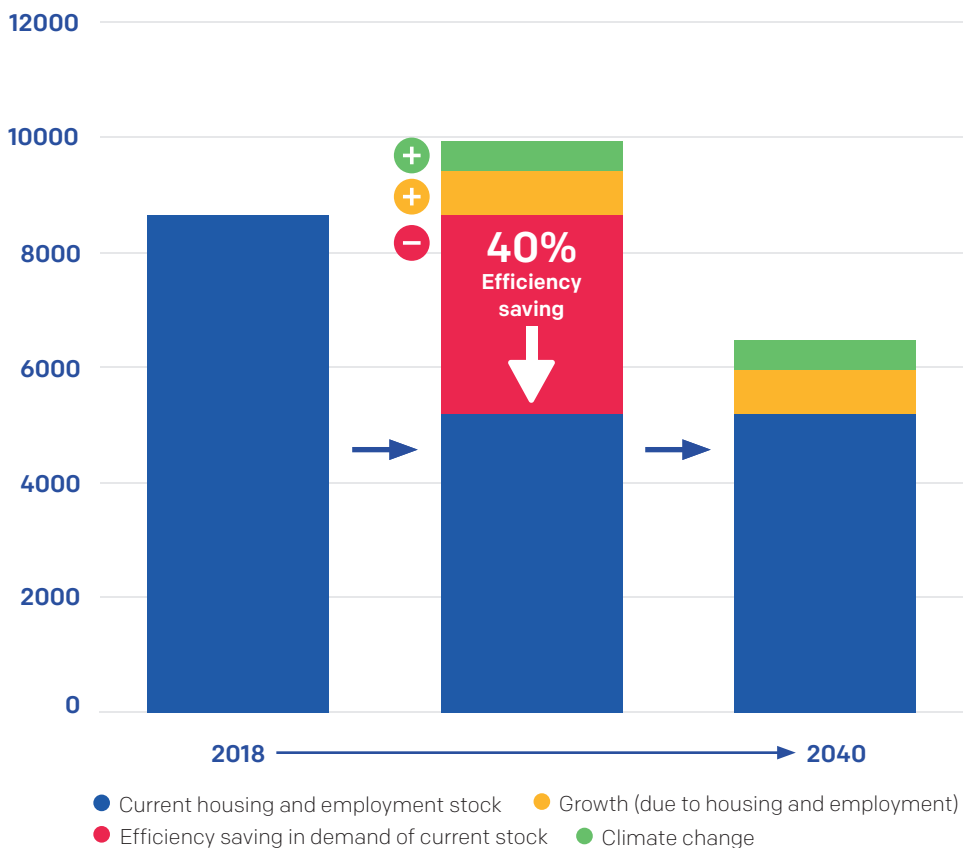
## Efficiency of new and existing buildings

Creating a new heat infrastructure will make heat more expensive than existing, and it is unlikely to be able to deliver the same amount of low / zero carbon heat as the existing network. Therefore, it will be essential for GM's heat demand by 2040 to be substantially reduced. A step change in the energy efficiency performance of existing domestic and non domestic property will have to be achieved – including retrofitting existing buildings, with new buildings designed to higher standards.



**Key Challenge 2: There needs to be a substantial programme of reduction in heat demand from existing and new buildings**

**GM Peak Heat Demand (MW)**



Heat demand associated with climate change is uncertain and could increase in response to extreme weather conditions.

Efficiency savings required in order to drive down the demand for low/zero carbon heat.

Potential 2040 demand is illustrated based upon a 40% reduction in heat demand due to efficiency savings which requires a fundamental shift in the scale of retrofit of existing buildings and higher standards for new build.

**To solely offset the increase in heat demand due to growth a reduction in heat demand of around 10% would be required. However, to achieve a net zero carbon future, an efficiency saving of at least 40% will be necessary. A 40% reduction in heat demand will require a fundamental shift in the scale of retrofit.**

# Electricity

There are a number of key trends affecting Greater Manchester's electricity demand to 2040:

## Population and employment growth

A growth in population and employment is likely to drive an increase in electricity consumption.

## Efficiency, digitisation and smart environments

There is likely to be some reduction in electrical demand due to increasing electrical efficiencies of property, lighting, and appliances; this could be up to a 20% reduction. However this may be offset by the increasing digitisation and adoption of digital technology. Greater Manchester will become increasingly reliant on electricity, as systems become 'smarter' and more technology enters daily lives. There will be increasing energy demands associated with digital infrastructure (e.g. data bases, servers) and the overall resilience of the digital and electricity networks will become of increasingly high importance.

When just the factors above are considered there is unlikely to be a significant net increase in electrical demand in GM to 2040, albeit that there will be a need to increase distribution capacity in local areas, where the rate of population increase is proportionately higher. There are, however, key two factors which could have a significant impact on GM electrical infrastructure.

- Electrification of heat, arising from decarbonisation, and
- Electrification of transport (ultra-low emissions vehicles) – due to decarbonisation and air quality.

## Decarbonisation of heat

As discussed in 'Heat', there remain a number of options for the decarbonisation of heat. To understand the potential impact on the electricity distribution network we have indicated the potential electrical demand from heat on the graph on the subsequent page, based on 90% of GM's 2040 heat demand (SCATTER, 2017) being supplied from the electricity distribution network. In itself this assumes a substantial reduction in GM's heat demand from now to 2040.

## Ultra-low emissions vehicles and air quality

As transport transitions towards low-carbon and ultra-low emissions vehicles, an increasing prevalence of electric vehicles and associated charging facilities could have impacts on the peak electricity demand - although uncertain, high-level estimates indicate it could result in an additional 500MW on the networks peak demand (assuming mostly overnight charging).

Charging technology is moving forward rapidly with the emergence of faster chargers which in turn require far larger peak power demand of anywhere from 0.35MW to 1MW each. If just 200 cars utilised these at the same time it could represent approximately 10% of GM's current peak electrical demand. The charging of EV's will therefore need to be managed to spread the load across times of lower demand.

Other transport electrification, such as the power demand for HS2 and future rail networks will have a local impact (e.g. HS2 could require up to 5% of GM's existing peak demand) but through the work ENWL are undertaking, these projects are not expected to significantly impact on the overall electrical infrastructure.

## Decarbonisation of all electricity supply

The UK government have set objectives for the carbon emitted from electricity generation to be largely removed by 2050. The National Infrastructure Assessment recommends that by 2030 at least 50% of electrical generation should be by renewable sources.

Whilst much of this change will happen outside GM, for example with the increasing investment in off-shore wind, there will be a need for some of GM's electricity demand to be met from renewable generation inside GM.

Increasing efficiency of local renewable technologies is likely to encourage more local renewables, but national government and the energy regulator is also likely to change regulations and pricing structures to encourage changes in customer behaviour.

Therefore by 2040 it is likely that more individual households, businesses, landlords and institutions will generate their own renewable energy. Building integrated energy supply (e.g. solar panels) and storage infrastructure (e.g. batteries) at a local or community level will become the norm, with consumers becoming producers of electricity for the grid at some times of the day. The local electricity distribution system will therefore need to accommodate this more complex pattern of electricity supply and demand.

The trends highlight there is likely to be an increase in peak demand on GM's electricity distribution network, driven largely by growth and the increasing electrification of heat and transport. Mitigation of this growth will come from increasing efficiency of electricity demand, increases in local generation, and the use of smart technologies, more flexible pricing, and local storage to spread peak loads across the day. The extent to which this mitigation offsets the increase in peak load remains unclear, subject to all the uncertainties described above.

As an illustration, taking a business as usual approach, the impact on the electricity grid can be measured by the number of Primary substations. At present GM has around 150 primary substations with an overall peak supply capacity of approximately 3200MW, and these are currently meeting a peak demand of 2200MW. The potential increase without electrification of heat is approximately 600MW which is equivalent to around 25 primary substations that could equate to a cost of circa £125m. If electrification of heat was to be included, this would equate to around 170 new primary substations that could equate to a cost of circa £850m, and for scale, the increase in peak demand is equivalent to more than 30km<sup>2</sup> of photovoltaic array.

This would depend on the extent to which the existing spare capacity can be exploited to meet the spatial extent of the new demand.

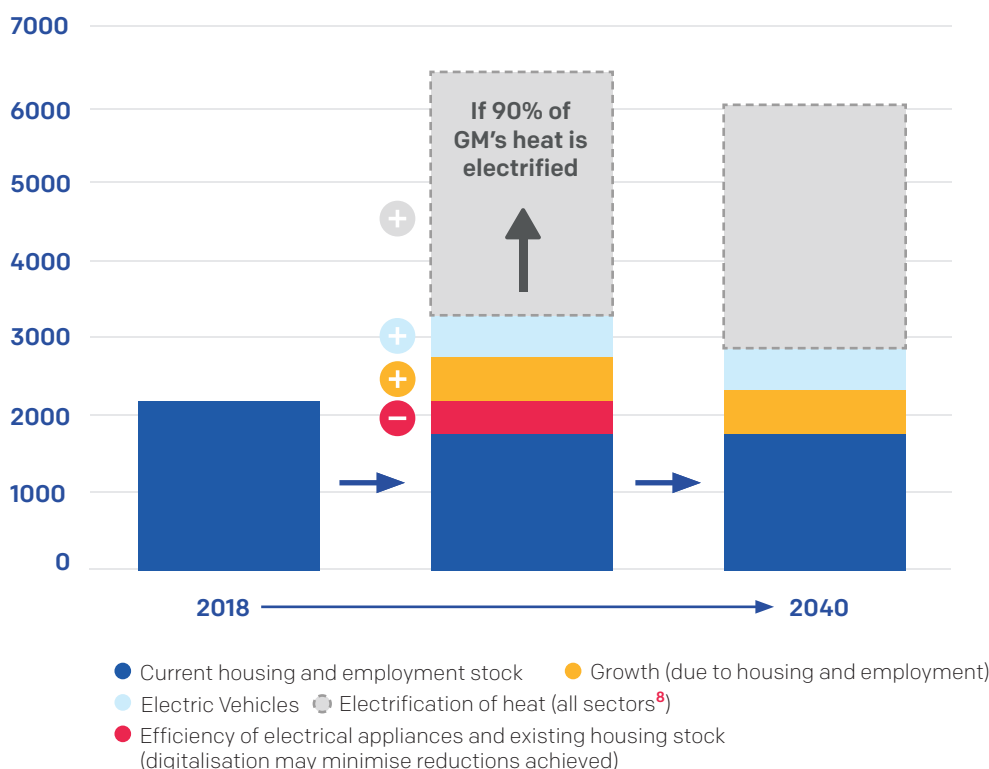
Clearly, doubling the distribution capacity of the electrical network under a business as usual approach is extremely onerous and; therefore, a fundamental change in the way the electrical infrastructure operates and is used must be taken.



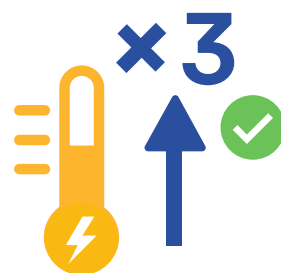
**Key Challenge 3: The current electrical infrastructure needs to be able to accommodate the growth of local renewable generation, rapid electric vehicle charging and, potentially, the electrification of heat**

## Impact on the Future of GM's Electricity Demand

### GM Peak Electricity Demand (MW)



Growth in electrical demand from EVs is equivalent to the demand from housing and employment growth.



**Electrified heating can be up to 3x more efficient**

8. Assumed a scenario where, to support decarbonisation, 90% of heating (based on SCATTER research) is provided electrically (50% via heat pumps, 50% via direct electric heating)

# Transport

There are considered to be a number of impacts on Greater Manchester's transportation demand to 2040:

## Population and employment growth

Greater Manchester is forecast to grow significantly by 2040. The predicted increase in employment and population growth is forecast to result in an additional 800,000+ trips per day by 2040. Concentrations of growth are predicted in the City Centre, the Quays, Airport Gateway and the main town centres. This growth has the potential to increase congestion and delay across all modes of transport. High capacity, sustainable transport provision will be crucial to support and enable the planned growth and minimise congestion, especially within these areas.

Major transport projects including HS2 and Northern Powerhouse Rail are proposed to increase the capacity and connectivity of routes from Greater Manchester to London, Birmingham and major cities within the North.

## Demographic change, urban densification and more conscious consumers

Further impacts on the length and number of trips in Greater Manchester will occur due to demographic changes. These changes include an aging workforce and changing and flexible working practices, which may reduce proportion of travel in the traditional 'peak' hours. The increasing prominence of online retail may reduce personal shopping trips, but will increase demand for home deliveries, and impact upon logistics and distribution networks to achieve faster delivery times.

It will be critical that transport infrastructure ensures that areas of higher deprivation within Greater Manchester have access to economic opportunities across the City Region. The emergence and growth of the 'sharing economy' could result in a reduction in individual car ownership and subsequently reduce car-based journeys. Conversely, it is considered that a changing workforce, involving more productive, higher skilled workforce, in higher paid jobs, focusing on more specialised and skill activities, may lead to increased commuting distances and more complex travel patterns.

## Smart environments and technological advances

Mobility as a Service (MaaS) – i.e. a single integrated system of payment/access for all modes of transport, is likely to be extensively used within GM by 2040. MaaS with connected smart devices could allow transport services to evolve as they are accessed – enhancing delivery and creating a smart transport network. With radical technological advances in the transport networks (including autonomous vehicles) anticipated by 2040, the impacts on existing infrastructure will need to be considered, supported by appropriate strategies and policies where appropriate.

## Air quality, improved connectivity and more conscious consumers

At present over 60% of trips in Greater Manchester are made by car – over the coming decades, measures to tackle road congestion, improve air quality and promote public health will promote a shift to other forms of transport and active travel (e.g. walking and cycling). This will need to be supported by the right investment and infrastructure, whilst considering improvements to connectivity by all modes across the wider region. Increasing awareness of the adverse impacts of car travel on the environment and public health may also contribute towards an increase in walking and cycling alongside public transport.



**Key Challenge 4: Greater Manchester's transport infrastructure networks should provide the capacity, connectivity and diversity to meet the future needs of its residents**

**NPR will increase the number of people within a 60minute train journey of 4 or more major northern cities from 10,000 to 1.3million (TfN, 2017)**

**Transitioning to 100% ultra-low emissions vehicles will require charging infrastructure for around 1.15million cars in GMCA**

**Based on present number of vehicles in GMCA**



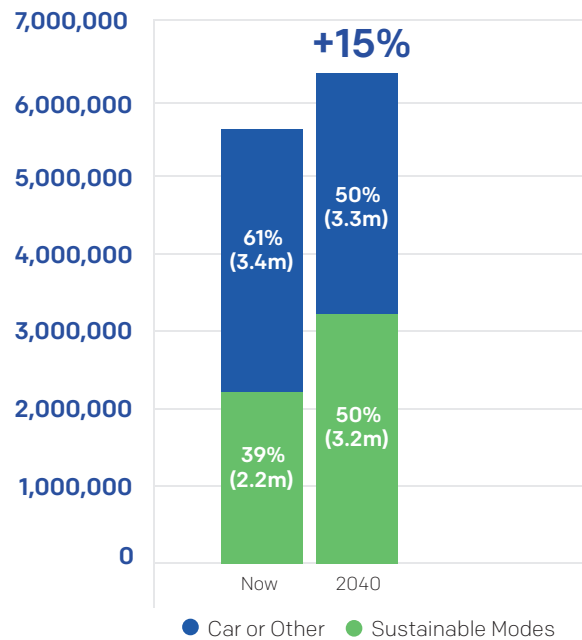
Decarbonisation and ultra-low emissions vehicles

SCATTER scenario planning suggests Greater Manchester will need to transition to 80-100% electric, hybrid or hydrogen vehicles (including cars, trucks, buses and rail) by 2040 to achieve its emissions targets. With the move to ultra-low emissions vehicles, provision of charging, re-fuelling and parking infrastructure (and supporting policies) will be required to facilitate this transition. This will need to accommodate the use of electric, hydrogen or hybrid vehicles; whilst considering the emergence of other new technologies.



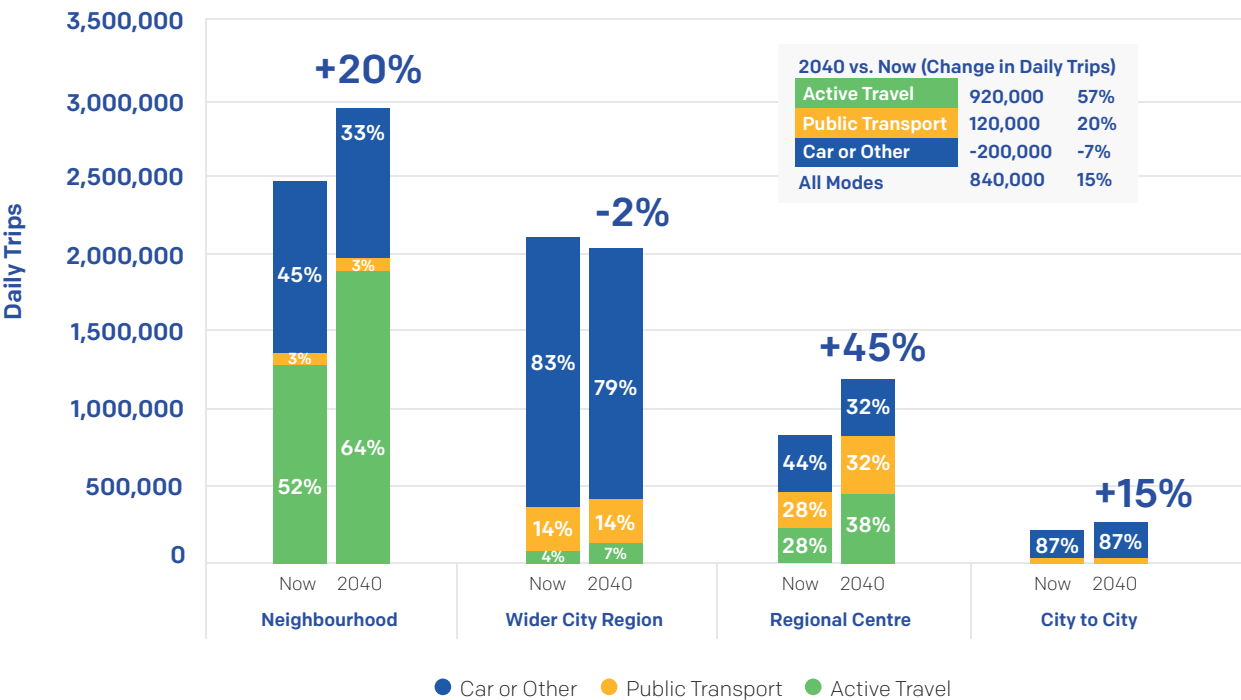
Key Challenge 5: Greater Manchester needs the infrastructure to support ultra-low emissions vehicles

GM Mode Share Vision (overall)



Source: 'Now' calculated using GM TRADS Years 3-5 (2014-2016)

GM Mode Share Vision (by trip type)



A high-level assessment of the number of daily trips within four spatial themes in Greater Manchester. The 2040 scenario represents the vision for Greater Manchester's travel considering future trends and aspirations of TfGM. (TfGM, 2018)

## Potable Water

Overall as a City Region, there are no deficits of water supply forecast for Greater Manchester in 2040.

Despite population and economic growth, there is expected to be a reduction in potable water demand in Greater Manchester over time. This is due to the following aspects:

- **Water Efficiencies:** Increasing sustainable construction methods, more water efficient appliances, increased implementation of measures to re-use water (as grey water recycling systems) and changing behaviours to water usage should have a large impact on reducing the demands on the water supply. UU expect to there to be a annual saving of 1 litre per property per day up to 2040 (WRMP, 2019),
- **Water Metering:** Customers with a meter typically use less water than those without one. Over the next 25 years we expect meter penetration to increase to 76% across Greater Manchester. Reducing consumption from an average of 160l per person/day to 137l per person/day.

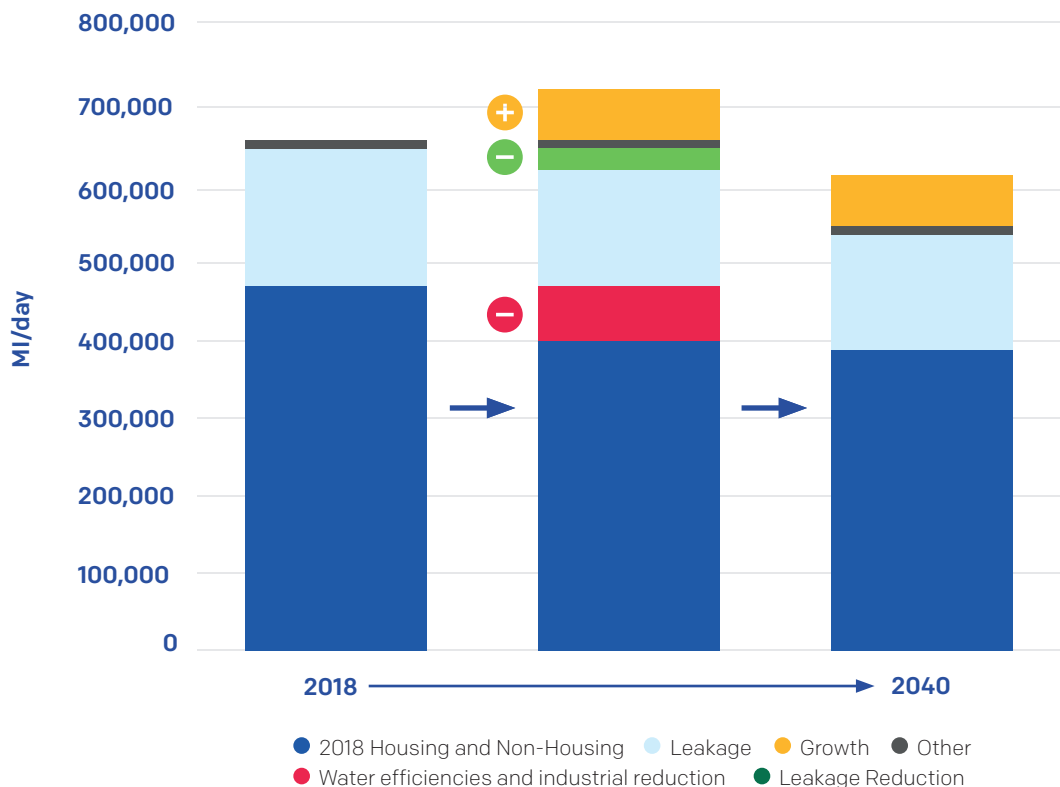
- **Leakage Reduction:** Leakage management contributes to an overall reduction in demand. By 2040 UU aim to achieve a minimum of a 17% reduction in leakages to conserve water throughout Greater Manchester and the North West.

Up to 2040, the potable water system is expected to have a 'good' (UU, 2018) level of resilience to extreme droughts, which is made possible by the leakage reductions and water efficiency measures.

No key challenge has been identified as it is recognised United Utilities are leading on the aspects highlighted above through existing funding mechanisms. GMCA should support these goals.

It should be noted that despite the anticipated reduction in aggregate demand across the region there will still be local pinch points associated with the limitations of existing assets.

**GM Peak Demand (Million Litres/Day)**









# Flood Risk, Surface Water and Waste Water

## Population and economic growth and climate change

The triple challenges of population growth, new development (increasing the proportion of hard surfaces and resulting in a potential rise in surface water run-off flow) and climate change will mean the performance of Greater Manchester's drainage and sewerage systems and flood defences may fall below standard.

The increase in significance of flood events will have a detrimental impact on the city region, its citizens and economy if it is not sufficiently protected. This is particularly the case in areas of social deprivation or where there are areas of high economic activity that are densely populated as this has a knock on effect on supply chains. Additional investment in infrastructure will be needed to ensure Greater Manchester is fully resilient to such changes.

There will need to be a shift to more nature-based solutions (e.g. natural flood management) to support traditional flood alleviation schemes and catchment-wide approaches. Such measures will need to be combined with the implementation of sustainable urban drainage solutions which will be essential to reducing surface water run-off (flow rate and volume), mitigating flood risk and heat stress.



**Flood risk can occur from a number of sources including fluvial (river), surface water (overland flow), groundwater and sewer flooding.**



**Challenge 6: Provision of infrastructure that maintains and/or reduces flood risk across Greater Manchester whilst accommodating developmental growth and climate change**

## Flood and Coastal Risk Management Programme

Within Greater Manchester the current FCRM programme (2015/2016 – 2020-/2021) identifies both surface water (Lead - Local Authority/other RMA) and fluvial (Main River) (Lead - EA) capital schemes. Out of this capital schemes have already been delivered to protect over 2400 properties. For projects yet to be delivered capital costs are estimated to be in the region of over £45million to protect over 1800 properties.

There are currently 96 FRM schemes in Greater Manchester within the six year Investment Programme intending to protect 10,367 properties at a cost of £236.6m.

**The identified new development sites for housing and employment growth in GM are predominantly in urban areas and brownfield sites. Recognising that much of the brownfield land stems from GM's industrial heritage and its close tie with watercourses, it is likely a higher risk of fluvial flooding will be encountered in these development locations.**

## Environmental regulations, water quality and bio-diversity

By 2040, it is expected that waterbodies within Greater Manchester will have achieved the required environmental targets and support cleaner water, better managed habitats and more naturally functioning and resilient water bodies. At present, over 90% of water bodies in GM are failing their objectives under the Water Framework Directive (WFD), with most classified as 'moderate' status. In particular, the North-West River Basin Management Plan states that the priorities for the Irwell Catchment are to address diffuse urban pollution, physical modification and contamination from sewage treatment. (SFRA, JBA, 2018). There is still considerable work to be undertaken to achieve the aims of the WFD, which will require the co-ordination of a number of bodies including the EA, UU and GMCA.

## Major Project: EU LIFE Funded Natural Course Project:

Aimed to improve integrated water management and tackle and overcome the issues and barriers to achieving objectives of the WFD. The project lasts for 10 years, up to 2025, and is lead by the Environment Agency in partnership with local organisations and authorities. GM organisations should work together to delivery integrated water management solutions, tackling issues such as diffuse pollution and flood risk management.

## Further considerations: funding and resources

There are significant funding challenges with regards to the delivery of flood risk infrastructure in Greater Manchester. Government funding for flood risk infrastructure (Grant in Aid) often requires partnership contributions and it is heavily skewed towards the protection of residential properties. As a result urban areas which are predominantly commercial/office led require greater partnership contributions to be eligible for Grant in Aid funding. It will become increasingly difficult to deliver further reductions in flood risk across the City Region without identifying where additional investment can be leveraged. As such there will be a need to understand wider economic business drivers and funding to identify additional investment in flood protection, this could also include other infrastructure programmes which align with the Environment Agency's FCRM schemes.

For Lead Local Flood Authority schemes the availability and skills of resources across Greater Manchester has been an issue which has impacted on previous delivery for the current FCRM programme. This issue could continue if the resource gap is not filled.



**5,800**

**5,800 homes are protected by  
existing flood defences  
(EA, 2018)**



## Historic Sewer Flood Incidents in GM (Draft SFRA)

— GMCA boundary

— Local authority boundary

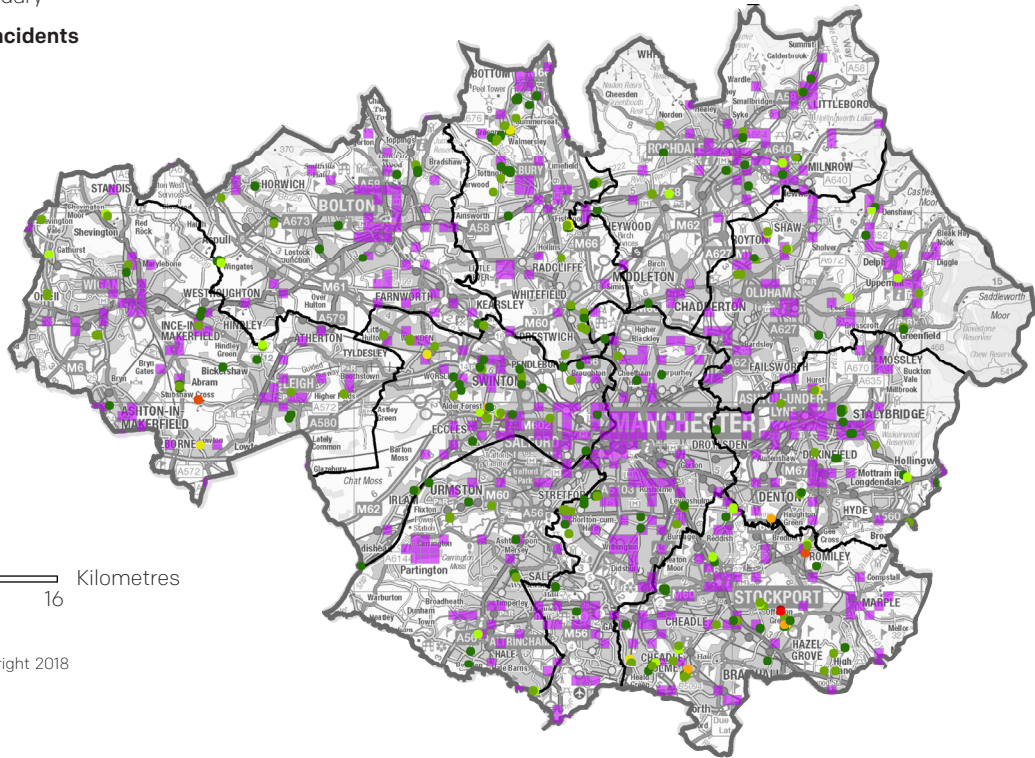
### Number of sewer flood incidents

- 295
- 208
- 41-60
- 21-49
- 11-20
- 6-10
- 2-5
- 1
- Hotspots (GM SWMP)

0 4 8 12 16 Kilometres

Contains OS data

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## Water Quality of Watercourses in GM (2018)

Water Framework Directive Rivers, Canals and Surface Water Quality Status:

- High
- Good
- Moderate
- Poor
- Bad
- No data



## Flood Risk from Rivers in GM (2018)

### Flooding

- EA Flood zone 2 - land assessed as having a 1% – 0.1% annual probability of river flooding.
- EA Flood zone 3 - land assessed as having a >1% annual probability of river flooding.

Risk of flooding from rivers and sea:



# Green and Blue

## Population and employment growth

Increasing population and employment growth is driving the need for further development in Greater Manchester, placing pressures on the existing finite green and blue space within Greater Manchester. Similarly, there are associated infrastructure space requirements, including consideration of space for low-carbon energy generation (e.g. photovoltaics, bio-mass production), new sub-stations and data centres or natural flood risk management programmes. With greater pressures on land and increasing populations, it will be more important than ever to maximise the quality of, and the ecosystem services available in, our existing natural assets, and that appropriate policy and safe-guards are implemented to use and manage our land sustainably.

## Recognition of the value of blue and green infrastructure and aspirations of national government and residents in Greater Manchester

With the increasing recognition of the importance of green and blue infrastructure to our economy, health and social well-being, coupled with aspirations of the UK Government (in the 25 Year Environmental Plan) and local residents, there will need to be a drive to provide high quality green and blue spaces close to where people from all communities live and work, with increased bio-diversity across Greater Manchester.

The increasing use of Natural Capital and Environmental Net-gain will help to provide the means by which to progressively improve the region's green and blue infrastructure towards these goals. Applying this way of thinking to projects and investment decisions can often yield benefits to stakeholders that are not always considered in traditional economic and commercial assessments.

As the Urban Pioneer (one of four cities nominated to help achieve the aims of the Government's 25 Year Environmental Plan (25YEP), GM is developing Urban Natural Capital Accounts – looking to map and identify the value of the natural assets within the City Region to support future decision making and the protection and enhancement of the existing natural assets.

The study has assessed nine different benefits from natural capital in the GMCA area, which have a combined value of nearly £1bn per year (£860m). Assuming these benefits continue over time, the natural environment is a £24bn asset to the people of Greater Manchester. These benefit estimates demonstrate the value if assets are maintained, or the value that could be at risk if not maintained - the societal return of investment in natural capital in GMCA.

The challenge is integrating the outputs into the investment decision making of numerous bodies and developers across the wider City Region.

## Climate change

Green and blue infrastructure will play a vital role in adapting to, and mitigating the impacts of, climate change, such as heat and flooding. Retrofitting green infrastructure into our existing City Region and ensuring adequate provision within new developments remains an on-going challenge – particularly in the face of economic pressures.

## Other considerations: funding and resourcing

Green and blue infrastructure has no direct funding stream (unlike potable water, transport etc.). These challenges often present long-term uncertainty in terms of resourcing and financial funding for driving the green blue agenda forward.



**Challenge 7: Maximising the eco-systems services provided by green and blue infrastructure, whilst responding to spatial pressures on finite space and improving accessibility**



**Total Benefit (per year) = £866m**

Air quality **£41m**  
 Recreation **£372m**  
 Physical health **£56m\***  
 Mental Health **£264m**  
 Local climate **£4m**  
 Carbon **£2m**  
 Food **£50m**  
 Noise **£3m**  
 Minerals **£74m**







# Digital

## Digitalisation and Smart Environments and Networks

Digital technology is increasingly the backbone of the major industries and our daily lives. Embracing such technology throughout all sectors, geographies and occupations is fundamental to Greater Manchester's current and future international competitiveness (GMCA, 2018). To maintain our competitive advantage GM will need to be looking at 75% to 80% household and business coverage by 2024 and full coverage by 2028; equating to around 98% fibre – 2% through other technologies.

Over the years approaching 2040, GM will move to become a smart and digitally-ready city region. To achieve this vision, the future digital infrastructure will require strong fixed resilience connectivity, supported by 5G (and beyond), big data systems and other nascent technologies such as Artificial Intelligence and machine learning. Without connectivity, processing the sheer volumes of data necessary to create a network of communicating devices will be impossible. As such, significant improvements are required to increase the provision of wired (through full fibre to the premises) and wireless (through 5G, or subsequent technologies, and wifi provision) across Greater Manchester. Without the more basic technology solutions (such as pervasive fibre connectivity and 5G), the smart-region solutions and value-added outcomes will struggle to be brought to fruition.

Notably, Greater Manchester is already undertaking a series of actions to move towards wider fibre connectivity, including:

- Aspirations of the Digital Infrastructure Plan to achieve full fibre to 90% of GM businesses by 2025.
- A Local Full Fibre Networks (LFFN) funding investment programme to help achieve Full Fibre to the Premises coverage to 25% of GM Premises by the end of 2020.

5G roll out is expected from 2020, with Vodafone and SSE already making investments in infrastructure. However, the timing and costs of roll out is uncertain and international standards have yet to be agreed. It is possible that there will only be one network upon which providers deliver their services or that each provider might need to invest. Estimates of market investment could therefore be anywhere between £1bn and £4bn to deliver 5G across GM by 2030.



### Challenge 8: Implementation of the GM Digital Strategy to provide pervasive, affordable, resilient digital connectivity

### Cost estimates of full fibre connectivity in Greater Manchester:

1.17M households in GM and 100,000 business premises

- 25% by 2020 using £40m Local Full Fibre Networks / LA & CCG funding & estimated £200M market investment (300,000 premises covered @ £800 each)
- 75% by 2024 – market investment - c600,000 premises @ £800 each = c£480M market investment needed

Final 25% by 2028 = 300,000 premises @ 1,000 each (to reflect increased geographical barriers) = c£300M investment

Total investment required to deliver full fibre across GM estimated at c £1Bn

All assumes we minimise barriers and costs to investment as far as possible.



**BT report that there is already considerable full fibre provision within their networks in Greater Manchester. The barrier to access is the final connection to premises.**

(BT, 2018)



**WiFi provision is patchy in public places and there are still barriers to access (registration requirements and cost) in many parts of GM**

(GMCA, 2018)



## Cross Sector

There are also three cross sector Key Challenges that have been identified through the development of this document which exist presently, but are exacerbated by the future trends and changes in infrastructure demand:



### **Key Challenge 9: Greater Manchester's infrastructure needs a collaborative and co-ordinated approach to meet the present and future needs of the region**

Infrastructure within Greater Manchester (and across the wider UK) is owned and managed by a multitude of organisations/providers. Greater Manchester has limited direct control over the provision or decision-making processes within these sectors.



### **Key Challenge 10: Funding models are needed to meet present needs and enable change for the future**

The present funding challenges to meet the current infrastructure needs for Greater Manchester will be exacerbated by the scale of future change



### **Key Challenge 11: Infrastructure that is resilient to shocks and stresses**

Ensuring the security of supply throughout each day – energy, transport, water etc. against challenges associated with aging assets, increasing exceptional events 'shocks' particularly in the face of climate change (and it's effect of increasing the frequency of extreme events) and demographics and population changes 'stresses'.

## The Framework

This Framework identifies: responses required by Greater Manchester and other stakeholders to address the identified Challenges; opportunities for collaborative working to be ready for, and capitalise on, anticipated changes; and to position Greater Manchester at the forefront of a changing dynamic of infrastructure use.

The Framework further identifies where existing plans and programmes are already being undertaken across GM, which are relevant to specific aspects of the responses identified, and where it is felt that these need to be extended through additional initiatives.

The Framework should be considered alongside the GMSF and Local Industrial Strategy. Any future programmes to take forward the responses outlined should be developed jointly with both these initiatives in mind.

## Key Challenge 1: Greater Manchester needs infrastructure capable of delivering low/zero carbon heat

Response	Stakeholders
<p>There is uncertainty of what infrastructure or infrastructures will be needed to deliver low/zero carbon heat. More technical and financial assessment is needed at both GM and national scale, but the accelerated timetable that GM are considering for moving to zero carbon may mean that the GM solution may differ in some respects from any emerging national solution.</p> <p><b>1A GMCA to understand the implications of 100% hydrogen to replace natural gas in the existing gas network</b></p> <p>GM should continue to support the HyNet programme being led by Cadent that is trialling the production of hydrogen from natural gas and enabling domestic, non-domestic and transportation usage;</p> <p>The National Infrastructure Assessment recommends that community-scale trials are undertaken for 100% hydrogen as a replacement for natural gas by 2021; followed by a trial to supply at least 10,000 homes by 2023. GM should work with the NIC and Cadent to extend HyNet to bring the NIC's recommended trials into GM.</p> <p><b>1B Document the wide-scale applicability of options for delivery of electrical heating by heat pumps across GM's existing domestic and non-domestic properties</b></p> <p>The National Infrastructure Assessment recommends that an up to date evidence base is established on the performance of heat pumps within the UK building stock. Trials have already been undertaken within GM (e.g. the Smart Communities Project) that can input into this evidence base. GM and existing partners should work with the NIC to shape the evidence base.</p> <p>The emerging pathway from Key Challenge 3 should be drawn in to inform the capability of the electrical infrastructure to support electrification of heat.</p> <p><b>1C Continue scenario planning to determine the future balance of low/zero carbon heat between either hydrogen, electrified heat, district heating and other forms</b></p> <p>GM needs to continue to develop and refine the future scenarios for net zero carbon taking account of the emerging outcomes of the potential for low/zero carbon heat via either hydrogen or electrification (including heat pumps and direct electrical heating) and the role of districting heating schemes. This must also be considered in conjunction with the actions from Key Challenge 3 and Key Challenge 5 for ultra-low emissions vehicles which may rely upon hydrogen.</p>	<p><b>GMCA, the Ten Districts and Cadent</b></p> <p><b>GMCA, the Ten Districts, the NIC and Cadent</b></p> <p><b>GMCA, the Ten Districts, partners and the NIC.</b></p> <p><b>Key Challenge 3</b></p> <p><b>GMCA, the Ten Districts Key Challenge 3 Key Challenge 5</b></p>

### Relevant projects and programmes already underway or planned:

- GM Smart Energy Plan
- GMCA Hydrogen Framework
- Hynet Programme
- SCATTER scenario planning
- GM Low Carbon Hub

## Key Challenge 2: There needs to be a substantial programme of reduction in heat demand from existing and new buildings

### Response Required

### Stakeholders

#### 2A – Significantly reduce the heat demand of existing buildings

The National Infrastructure Assessment recommends that £3.8 billion is made available nationally between now and 2030 to deliver energy efficiency improvements in social housing. GM needs to work with the NIC to determine how this funding can be accessed and be part of the design and delivery of such a programme.

GM needs to shape a heat demand reduction and thermal efficiency programme across the city region including private sector housing. This programme must include behavioural change to enact change beyond fabric alterations.

The extent of this programme will need to be informed by the findings of Key Challenge 1 and the emergent future to provide low/zero carbon heat. SCATTER scenario planning provides an indication of the scale of retrofit required to achieve net zero carbon:

- Existing domestic and non-domestic stock to be retrofitted to achieve a minimum EPC rating of B/C
- 45-60% of homes are insulated to a sufficient extent to reduce thermal leakiness by 57-75%
- Average household room temperatures are reduced
- Space heating demand for commercial properties is reduced by 30-40%..

An ETI study (ETI, 2015) found that an extensive retrofit of a thermally poorly performing home could cost up to £31,000 per building if performed at an industrial scale and provide a reduction of around 45 % in CO2 emissions.

#### 2B – Significantly reduce the heat demand of new buildings:

GM needs to determine whether changes to local building standards for domestic and non-domestic thermal efficiency are locally required, in order to meet GM's low carbon objectives, and minimise the demand on GM's the future low/zero carbon heat infrastructure.

Building standards are likely to be needed to be implemented in policy and policed for implementation.

**GMCA, the Ten Districts, NIC, social landlords**

**GMCA , the Ten Districts and existing building owners.**

**Key Challenge 1**

**GMCA and the Ten Districts**

**GMCA and the Ten Districts**

#### Relevant projects and programmes already underway or planned:

- GM Smart Energy Plan
- GMCA Retrofit Plan
- SCATTER Scenario Planning
- GM Low Carbon Hub

Additional initiatives beyond those present programmes are likely to be needed to address the needs of Part 2B of this challenge.

### Key Challenge 3: The current electrical infrastructure needs to be able to accommodate the growth of local renewable generation, rapid electric vehicle charging and, potentially, the electrification of heat

Response	Stakeholders
<p><b>3A – Understand the opportunities and implications of a changing electricity distribution network and its regulatory framework</b></p> <p>GM needs to work with Electricity North West Ltd and ofgem to understand the proposed future operation of GM's electricity distribution network, and how future regulatory regimes, such as the transition of ENWL to a Distribution Service Operator, will assist in promoting the objectives of the GM Infrastructure Strategy.</p> <p>This work to include how the electricity industry and regulatory framework promotes local renewable generation and storage, and the management of additional demands from growth, EV and heat.</p> <p>GM and districts needs to consider the spatial requirements of the electricity distribution network, including the provision of substations in the planning of growth areas.</p> <p><b>3B – Provide greater definition of the scale and type of local generation needed to meet a zero carbon future, and the technologies required to facilitate its integration and demand management</b></p> <p>GM needs to work with stakeholders to promote the adoption of Smart City technologies, renewable generation, demand side response, and local storage, as a means of providing low/zero carbon electricity and reducing electrical demand on the grid.</p> <p>SCATTER scenario planning indicates the potential scale of local renewable generation required to move to a net zero carbon future as:</p> <ul style="list-style-type: none"> <li>- 16m2 of solar PV per household on 50% of all households in GM</li> <li>- A residual 16.8km2 required on commercial rooftops or on ground mounted installations.</li> </ul> <p>There are areas across GM that are planned for development but are not yet being developed. The opportunity should be explored for using these sites for the interim installation of PV farms or other forms of renewable generation prior to development.</p> <p><b>3C – Determine GM's Electric Vehicle charging electrical demand</b></p> <p>Refer to Key Challenge 5</p> <p><b>3D – Determine GM's potential future rise in electricity demand from electrification of heat</b></p> <p>Refer to Key Challenge 1</p>	<p><b>ENWL, ofgem, GMCA and the Ten Districts</b></p> <p><b>GMCA, the Ten Districts, ENWL, ofgem, UK Government</b></p> <p><b>GMCA, the Ten Districts and ENWL</b></p>

#### Relevant projects and programmes already underway or planned:

- GM Smart Energy Plan
- GoNeutral
- GMCA Hydrogen Framework
- Hynet Programme
- SCATTER scenario planning
- GM Low Carbon Hub

Additional initiatives beyond those present programmes are likely to be needed to address the needs of Part 3A of this challenge.



## Key Challenge 4: Greater Manchester's transport infrastructure networks should provide the capacity, connectivity and diversity to meet the future needs of its residents

### Response

#### 4A – Enhance the attractiveness and capacity of walking, cycling and public transport within GM.

The predicted scale of growth, and environmental issues, will require further investment and careful planning and management of transport systems, co-ordinated closely across Greater Manchester.

The Greater Manchester Transport Strategy 2040 establishes the basis for addressing this Challenge.

### Stakeholders

**GMCA, the Ten Districts, TfGM, Network Rail, Highways England**

#### Relevant projects and programmes already underway or planned:

- Congestion Deal
- Strategic Transport Plan
- Manchester North West Quadrant Strategic Study
- HS2 and Northern Powerhouse Rail
- Manchester Airport's Sustainable Development Plan
- Greater Manchester Moving Plan for Physical Activity and Sport
- Made to Move
- Greater Manchester Cycling and Walking Network
- Greater Manchester Cycling and Walking Infrastructure Proposal
- Bus Services Act 2017 and Bus Reform
- GMCA Case for Change
- Clean Air Plan
- Low Emission Strategy
- Air Quality Action Plan (2016-2021)
- Springboard to a Green City Region
- GM Low Carbon Hub

## Key Challenge 5: Greater Manchester needs the infrastructure to support ultra-low emission vehicles

Response	Stakeholders
<p><b>5A - Determine Greater Manchester's role in setting the future for electric vehicle charging and hydrogen re-fuelling</b></p> <p>This approach must also be co-ordinated with GM's strategy for air quality to ensure that it supports the need to reduce vehicle emissions at the pace required for GM.</p> <p><b>5B - Determine the locations, scale and phasing of the key hydrogen demands for high torque transport (buses, HGVs etc.)</b></p> <p>Current evidence suggests that hydrogen is likely to be the preferred zero carbon fuel for High Torque transport. GM needs to understand the potential implications for GM of this.</p> <p><b>5C - Understand the travel and work patterns associated with electric vehicle charging to determine the location and capacity of the electrical infrastructure required</b></p> <p>Rapidly develop the approach for provision of EV charging points across GM, including home charging (allowing provision for homes without off-street parking), on- street parking, and car parks. GMCA, the Ten Districts, ENWL and TfGM to further determine how best to provide charging infrastructure to ensure a network of visible charging facilities in order to encourage uptake of EVs.</p> <p>This should consider the charging rate and the smart management of charging to minimise impact on network peaks.</p> <p>This should also note the NIC's recommendations that:</p> <ul style="list-style-type: none"> <li>- Local authorities should work to allocate 5% of their on-street parking spaces by 2020 and 20% by 2025 for electric vehicle charge points.</li> <li>- Ofgem should immediately take on the role of regulating the interaction between electric vehicle charge points and the electricity network.</li> </ul>	<p><b>GMCA, the Ten Districts, TfGM and the NIC</b></p> <p><b>GMCA, the Ten Districts, TfGM, Cadent and industry</b></p> <p><b>GMCA, the Ten Districts, TfGM, GMEV forum and other user groups</b></p> <p><b>GMCA, the Ten Districts, TfGM and ENWL</b></p>

### Relevant projects and programmes already underway or planned:

- Clean Air Plan
- Low Emission Strategy
- Air Quality Action Plan (2016-2021)
- Springboard to a Green City Region
- GM Low Carbon Hub

Additional initiatives beyond those present programmes are likely to be needed to address the needs of this challenge.

## Challenge 6: Provision of infrastructure that maintains and/or reduces flood risk across Greater Manchester whilst accommodating developmental growth and climate change

### Response

Greater Manchester will need to understand the impacts from flood risk as a result of future climate change and what infrastructure investment is required to ensure the city region is resilient. Whilst there has been research on this to date, further assessment is needed to determine longer term impacts along with a wider strategy for investment.

#### **6A – Develop a robust funding strategy to provide flood risk infrastructure to support anticipated growth**

Additional investment in flood risk infrastructure is needed due to population growth and climate change.

#### **6B – Understand the implications for GM of potential future changes in the appropriate standards of protection against flooding**

The National Infrastructure Assessment recommends that UK government should set out a strategy to deliver a nationwide standard of resilience to flooding with

- an annual likelihood of 0.5 per cent by 2050 where this is feasible
- a higher standard of 0.1 per cent for densely populated areas where the costs per household are lower.

This could have significant implications for GM, these implications should be understood to inform GM's engagement with this strategy.

#### **6C – Complete actions from the GM Draft Level 1 Strategic Flood Risk Assessment**

This document recommends the following as further work to be completed:

- Deepen understanding of flood risk for currently unmapped areas and surface water flooding.
- Identify new locations for strategic flood storage.
- Data on flood risk incidents should be mapped and spatially stored
- Review existing flood risk management assets to inform capital programme.
- Identify organisational capacity within GMCA and the ten districts to deal with SuDS, adoption and maintenance

**GMCA, the  
Ten Districts,  
Environment  
Agency**

**Key Challenge  
10**

**GMCA and the  
Ten Districts**

**GMCA, the  
Ten Districts,  
Environment  
Agency and  
UU**

### **Relevant projects and programmes already underway or planned:**

- Strategic Flood Risk Assessment
- Urban Pioneer Strategic Plan

Additional initiatives beyond those present programmes are likely to be needed to address the needs of this challenge

## Challenge 7: Maximising the eco-systems services provided by green and blue infrastructure, whilst responding to spatial pressures on finite space and improving accessibility

Response	Stakeholders
<p><b>7A – Enable an economic value to be placed on green and blue infrastructure</b></p> <p>GM should develop the methodology to economically value green and blue infrastructure. This should include the identification of funding streams to develop the Natural Capital agenda further and provide long-term certainty and resources to integrate the outputs into investment decision making across Greater Manchester.</p>	<p><b>GMCA and the Ten Districts</b></p>
<p><b>7B – Implement an environmental net-gain approach</b></p> <p>Each development that occurs within GM should provide a net benefit to the eco-systems services. Determine how an environmental Net Gain approach can be implemented as rapidly as possible and applied to all development projects and the feasibility of application to new infrastructure projects. New developments to include SuDS wherever possible to provide increased green infrastructure, mitigation of surface water runoff and provide water quality improvement.</p>	<p><b>GMCA, the ten districts</b></p>
<p><b>7C – Continue to enable further schemes to increase the green and blue infrastructure schemes in GM</b></p> <p>The green and blue infrastructure of GM should be maximised by means outside of development projects. GM need to continue to promote greening of the City Region including the Northern Forest, City of Trees and other schemes that are increasing the green infrastructure provision.</p> <p>This should also consider how green infrastructure can be integrated into transport corridors.</p>	<p><b>GMCA, the ten districts</b></p> <p><b>TfGM</b></p>

### Relevant projects and programmes already underway or planned:

- Strategic Flood Risk Assessment
- Urban Pioneer Strategic Plan
- Natural Capital Investment Plan
- Urban Action Innovation Project
- Bio-diversity Net-Gain Guidance

Additional initiatives beyond those present programmes are likely to be needed to address the needs of this challenge



## Challenge 8: Providing pervasive, affordable, resilient digital connectivity

Response	Stakeholders
<p><b>8A – Ensure the digital leadership in GM remains relevant and tailored to the continually changing needs whilst driving uptake by consumers</b></p> <p>GM should determine how to increase the provision of wired (through full fibre to the premises) and wireless (through 5G, or subsequent technologies, and wifi provision) across GM. Identification of funding for the estimated £1 billion investment required to deliver full fibre.</p> <p>The Greater Manchester Digital Infrastructure Leadership Group (GMDILG) already exists. The membership and terms of reference should be tested to ensure they align with the future digital needs of GM.</p> <p>A programme to raise awareness and demand from consumers and property owners to support the uptake of FFTP and future digital technology.</p> <p><b>8B – Influence the development of digital infrastructure regulation to enhance alignment with GM interests.</b></p> <p>GM needs to review the current regulatory framework for digital infrastructure of digital communications and assess opportunities to influence policy in the interests of GM's Digital Strategy.</p> <p><b>8C – Streamline the process for installation of new infrastructure within the streetspace</b></p> <p>GM should develop adequate policy (i.e. wayleaves) and provision of space and duct routes necessary for the telecoms operators, as well as other public-owned infrastructure and estate/smart stakeholders. This will be supported by the NIC's recommendation that government should streamline the wayleaves and connection process are the same for digital infrastructure as for other utilities by 2019.</p>	<p><b>GMCA, the Ten Districts, telecoms providers Key Challenge 10</b></p> <p><b>GMCA, the Ten Districts, Key Challenge 11</b></p> <p><b>GMCA, the Ten Districts and telecoms providers</b></p> <p><b>GMCA and the Ten Districts</b></p> <p><b>GMCA and the Ten Districts</b></p>

### Relevant projects and programmes already underway or planned:

- GM Digital Strategy

Additional initiatives beyond those present programmes are likely to be needed to address the needs of this challenge

## Key Challenge 9: Greater Manchester's infrastructure needs a collaborative and co-ordinated approach to meet the present and future needs of the region

Response	Stakeholders
<p><b>9A – Determine the process to address future changes and challenges through the production of a GM Infrastructure Strategy</b></p> <p>The GM Infrastructure Strategy should develop an action plan to address the Challenges in this Framework.</p> <p>GM should engage with the National Infrastructure Commission to identify opportunities to support GM's infrastructure strategy.</p> <p><b>9B – Enable sharing of programmes, plans and projects between GMCA, the infrastructure providers and the ten districts and identification of collaborative funding opportunities</b></p> <p>There already exists a Greater Manchester Infrastructure Advisory Group (GMIAG) which includes representatives from GM and partners, and main infrastructure network operators and provides a forum for cross-sector conversations. The terms of reference of this group should be tested against the challenges set out in this Framework, and where appropriate its scope amended.</p> <p>Common guidelines for the communication between the infrastructure providers and the ten districts are needed to provide clarity on how and who should be spoken to and this approach should be consistent across the districts. Ideally projects and proposals should be packaged between districts so single conversations can be had with the infrastructure providers and holistic solutions to be reached.</p> <p><b>9C – Provide the capacity of GMCA, the districts and the infrastructure providers to enable the above</b></p> <p>The capacity of GM and the ten districts to understand and engage on infrastructure issues is limited by financial constraints and lack of direct experience of infrastructure networks. GM should consider how these challenges should be addressed to allow GM to fully engaged in coordination with other infrastructure stakeholders. It may also provide the platform to develop consistent approaches across each of the ten districts. Distribution of knowledge and experience is needed in both directions between GM-level and the ten districts.</p> <p>The powers and scope for some of the infrastructure providers is defined by national Regulators such as Ofgem and Ofwat. As part of the review of the role of the GMIAG, the extent to which the best solution for GM is curtailed by the regulators should be tested, and if necessary representations made by GM for alternative approaches.</p>	<p><b>GMCA, the Ten Districts and partners</b></p> <p><b>GMCA, the Ten Districts and NIC</b></p> <p><b>GMCA and the Ten Districts</b></p> <p><b>GMCA, the Ten Districts and the GMIAG</b></p> <p><b>GMCA, the Ten Districts and regulated Infrastructure providers</b></p> <p><b>GMCA, the Ten Districts and the NIC</b></p>

### Relevant projects and programmes already underway or planned:

- GM Infrastructure Advisory Group

Additional initiatives beyond those present programmes are likely to be needed to address the needs of this challenge

## Key Challenge 10: Funding models are needed to meet present needs and enable change for the future

Response Required	Stakeholders
<p><b>10A – Evaluate and articulate the total benefits of investment in infrastructure</b></p> <p>The evaluation needs to include:</p> <ul style="list-style-type: none"> <li>• The appraisal of less tangible, non-monetary benefits (like quality of life or community cohesion) that are often a key motivation for a project;</li> <li>• The wider / co-benefits that arise out of project implementation. This is particularly important for funding for flood risk infrastructure but is applicable across all forms.</li> </ul>	<p><b>GMCA and the Ten Districts</b></p>
<p><b>10B – Drive scheme agglomeration and long-term certainty</b></p> <p>Infrastructure investment schemes should be agglomerated wherever possible to maximise outputs from limited funds and co-delivered.</p> <p>The process to address future changes and challenges developed through a GM Infrastructure Strategy and the associated action plan should help to provide this agreed cross-sector approach and provide longer-term certainty to attract institutional or private investors.</p>	<p><b>GMCA, the Ten Districts and Infrastructure providers</b></p> <p><b>GMCA</b></p>
<p><b>10C – Identify alternative funding models that enable transformative funding, and partnership working amongst the GM infrastructure stakeholders</b></p> <p>The GMIAG should seek to more closely integrate and co-ordinate the strategic investment planning of the infrastructure providers against the proposals of GMSF and the outcomes of this framework.</p> <p>There are emerging means of local authorities borrowing from the Public Works and Loan Board to invest in infrastructure and reclaim benefits through regeneration / increased land values / increased tax etc. The methods for the value capture should be studied further and shared through GMCA and the Ten Districts.</p> <p>There are recent examples of investment ahead of need, particularly in the provision of primary substations prior to development commencing. The opportunities for extending this approach across other infrastructure forms should be assessed and should form part of GM's response to the consultation announced in the Budget Autumn 2018 regarding encouraging innovation in regulated utilities.</p> <p>In Autumn 2018 the Government announced that it will "introduce a simpler system of developer contributions that provides more certainty for developers and local authorities, while enabling local areas to capture a greater share of uplift in land values for infrastructure and affordable housing. The reforms include simplifying the process for setting a higher zonal Community Infrastructure Levy in areas of high land value uplift, and removing all restrictions on Section 106 pooling towards a single piece of infrastructure. The government will also introduce a Strategic Infrastructure Tariff for Combined Authorities and joint planning committees with strategic planning powers." GMCA should work closely with government to shape this towards Greater Manchester's needs.</p>	<p><b>GMCA</b></p> <p><b>GMCA and the Ten Districts</b></p> <p><b>GMCA</b></p> <p><b>GMCA, the Ten Districts and Infrastructure providers</b></p> <p><b>GMCA and the Ten Districts</b></p>

Additional initiatives are likely to be needed to address the needs of this challenge



## Key Challenge 11 Infrastructure that is resilient to shocks and stresses

### Response Required

#### **11A – Improve the understanding of the reliance of GM on resilience of its infrastructure networks, and based in this understanding deliver improvements in their individual and collective resilience**

There are increasing risks to infrastructure operations such as cyber risks and the interconnection electrical and digital networks as GM's infrastructure becomes smarter and more electrically reliant

Winter rainfall is predicted to increase by 13% causing a rise in flood risk, and flood risk can impact on all infrastructures considered within this strategy.

The infrastructure networks are also interdependent, for example where a failure of the transport network, prevents staff accessing the other utility infrastructures.

Infrastructure providers will increasingly need to understand the implications for the resilience of their networks, but also work collectively to understand the opportunities for co-delivery of programme to improve resilience of infrastructure across GM.

The GM Resilience Strategy currently being produced is specifically exploring the following for infrastructure:

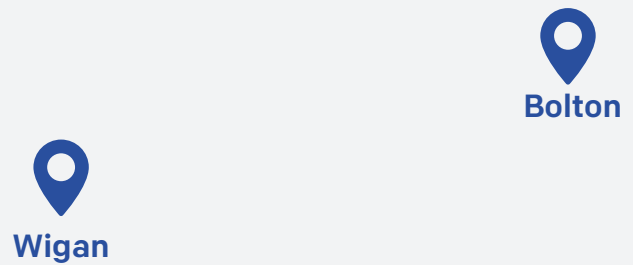
- The resilience of the electrical and digital networks as the future moves to an ever-increasing reliance on those
- Understanding of the various infrastructure providers and the role of GM in ensuring the resilience of the infrastructure networks.

### Stakeholders

**GMCA, the Ten Districts, Resilience Unit and Infrastructure providers**

#### **Relevant projects and programmes already underway or planned:**

- GM Resilience Strategy



## Typologies






### Introduction

Building on the framework identified for Greater Manchester, and in recognition of the development of the Greater Manchester Spatial Framework (GMSF), this section looks at three typical spatial typologies within Greater Manchester (each with a specific set of localised trends and challenges) and outlines a series of individual frameworks for each:

- Regional Centre
- Towns
- New hubs of development

It should be noted, that the GM Framework is over-arching to each of these and applies throughout.

For each of the spatial typologies, a high-level estimate of potential changes in demand to heat, electricity and potable water has been made; the purpose of which is to illustrate any future challenges to consider.

-  Towns
-  Regional Centre
-  Carrington - New hub of development
-  Airport Gateway
-  Northern Gateway (Bury/Rochdale/Oldham)- New hub of development



## Regional Centre

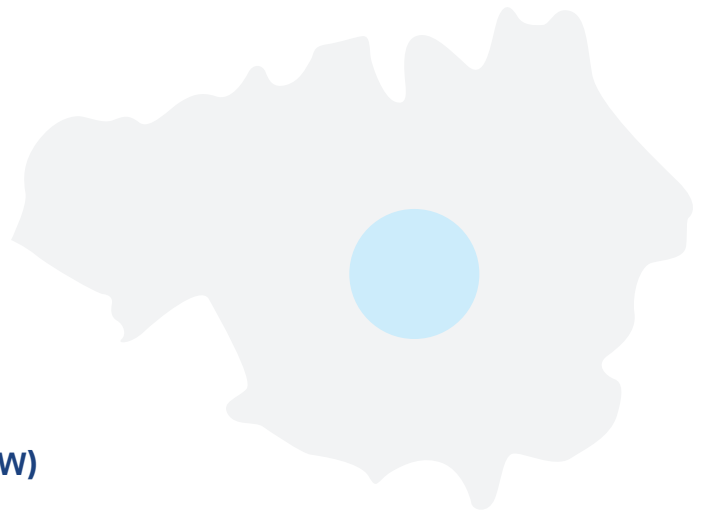
The centre of GM contains the most intensive concentration of employment within the city-region. It includes:

- Manchester and Salford City Centres
- Corridor Manchester (Oxford Road / Universities)
- Salford Quays / Media City
- Trafford Park
- The Etihad Campus

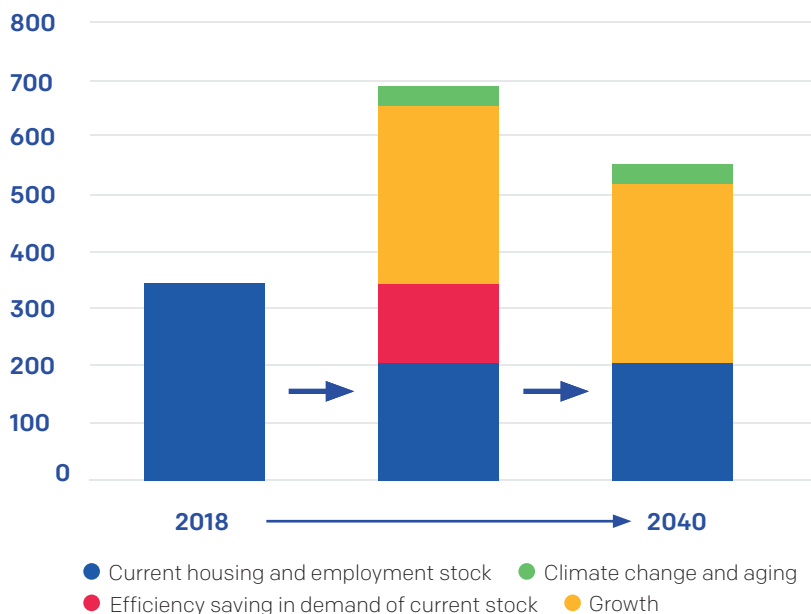
Over 100,000 people live in the Regional Centre, marking a growth of 120% over the previous decade, compared to 8.1% across GM over the same time period. There are now around 11,000 new residential units under construction in Central Manchester and Salford. Looking forward to 2040, significant growth is anticipated to be experienced and the Regional Centre will continue to provide a focus of increased levels of business, retail, leisure, culture and tourism activity. Whilst there will be efficiencies, due to the density of the Regional Centre, it will be a location in need of significant investment in infrastructure.

Development is expected to largely consist of apartments and high-rise buildings, increasing the density of the urban environment.

As a result, the Regional Centre is expected to experience localised infrastructure challenges in terms of capacity and peak demands of infrastructure. Whilst a smart infrastructure network will be critical to mitigating some of these issues, it is expected that localised reinforcements may be required. Space requirements for new infrastructure are expected to be challenging. For decarbonisation targets to be realised and as technology advances new energy, digital and transport infrastructure will all put pressures on the existing existing and proposed land uses.

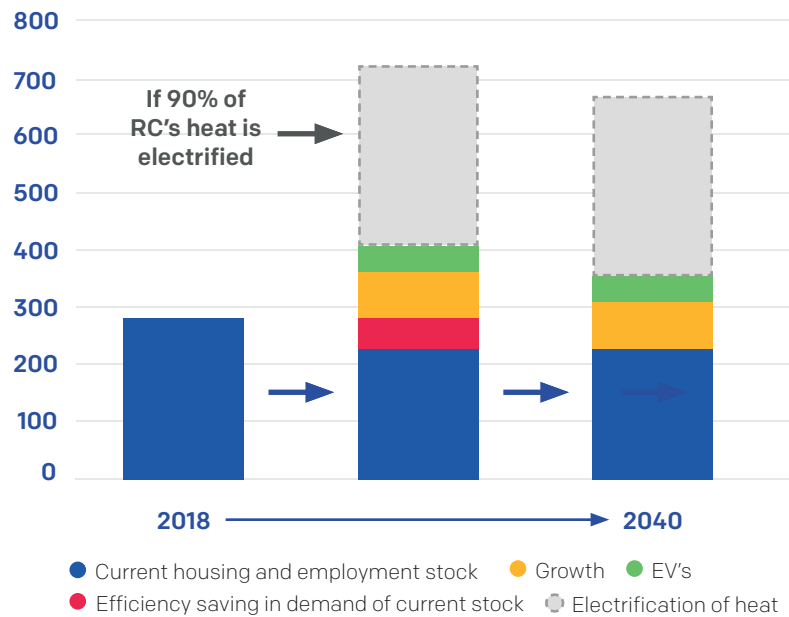


**Heat Demand**  
**Regional Centre Peak Heat Demand (MW)**

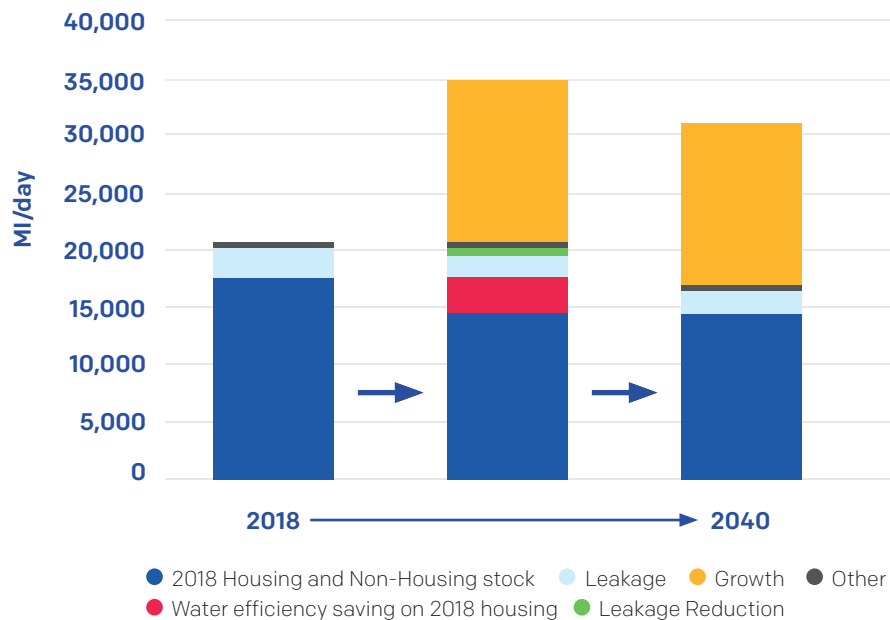




## Electricity Demand Regional Centre Peak Electricity Demand (MW)



## Potable Water Regional Centre



**Significant growth within the Regional Centre has the potential to increase demands significantly.**

## Regional Centre Framework

The Regional Centre Framework only addresses aspects where the required response to the challenges is different from the overarching GM Framework. Readers should refer to both frameworks when considering future programmes, actions or responses.

### Key Challenge 1: Infrastructure for low/zero carbon heat

#### Local Challenge / Opportunity

High density areas with high heat demands areas may provide opportunities for district heating and cooling systems.

#### Response

GMCA and the Districts need to continue to explore the potential, and develop an approach for, the implementation of heat networks through this area.

#### Stakeholders

**GM Low Carbon Project Delivery Unit**

#### Local Challenge / Opportunity

Many apartments are currently being built with direct acting electrical panel heating and, therefore, a switch to hydrogen for heating is unlikely to be feasible.

#### Response

GMCA and the Districts need to be aware that the use of electrical panel heating in new build apartments would necessitate decarbonisation of the electricity to deliver low/zero carbon heat. Future strategies for low/zero carbon heat will need to account for this.

#### Stakeholders

**GMCA, the Districts and the NIC**

### Key Challenge 4: Capacity, connectivity and diversity of the transport networks

#### Local Challenge / Opportunity

Major transport projects and investment are improving national links to the Regional Centre – e.g. HS2, NPR.

#### Response

GMCA, the Districts and TfGM need to ensure these national and regional projects will need to be integrated into Greater Manchester's local transport networks.

#### Stakeholders

**GMCA, the Districts and TfGM**

#### Local Challenge / Opportunity:

Increasing density of people within the Regional Centre is an opportunity to provoke a shift in the use of streets from motorised vehicles to people and active travel.

#### Response

GMCA, the Ten Districts and TfGM should continue to develop further opportunities to promote active travel, and rebalance the public realm in the Regional Centre between active and motorised travel. Any new development proposals should provide access for non-car modes and create a high, quality environment for visitors, workers and residents to enjoy.

#### Stakeholders

**GMCA, the Ten Districts and TfGM**

## Key Challenge 5: Infrastructure to support ultra-low emission vehicles

### Local Challenge / Opportunity

Car ownership is typically lower in the regional centre

#### Response

Lower car ownership offers the opportunity for provision of fully electric car-share / car-club schemes as part of a low-car provision. GMCA, the Districts and TfGM, should explore associated opportunities to maximise this potential to reduce car usage within the Centre.

#### Stakeholders

**GMCA, the Districts and TfGM**

### Local Challenge / Opportunity

There is a significant number of cars that drive to the area for work and leisure which will bring a rise in EV charging potentially during the day and evenings.

#### Response

The GM-scale approach for ultra-low emissions vehicles should take due consideration of the regional centre's position as economic hub for the region and a major travel destination for both commuting and leisure car journeys.

#### Stakeholders

**GMCA, the Districts and TfGM**

## Challenge 6: Flood risk

### Local Challenge / Opportunity

The area has limited space for the provision of flood mitigation features.

#### Response

Space limitations mean solutions for local flow reductions are likely to involve more expensive buried storage options, further opportunities should be explored for the use of sustainable urban drainage options. Opportunities may exist to reduce river inflows to the regional centre by increasing storage in less densely populated upstream areas.

Increasing the coverage of green infrastructure through the Regional Centre will help to mitigate peak rainfall reaching the areas surface water networks and reduce the risk of flooding.

#### Stakeholders

**GMCA, the Districts and TfGM**

### Local Challenge / Opportunity

Significant presence of high value residential and non-residential assets.

#### Response

#### Stakeholders

## Challenge 7: Green and blue infrastructure

### Local Challenge / Opportunity

The area has limited existing green infrastructure.

#### Response

Opportunities should be taken to enhance the effectiveness of existing green and blue infrastructure – improving access for local residents in the centre. These may include:

- Supporting City of Tree's initiative to increase the tree density in the City Centre.
- Promoting the inclusion of Green and Blue infrastructure in regeneration proposals in the regional centre.
- A review of all under developed land in or adjacent to the regional centre, to understand the potential contribution to green and blue infrastructure, as permanent or interim uses.

#### Stakeholders

**GMCA and the Districts**

## Challenge 8: Pervasive, affordable, resilient digital connectivity

### Local Challenge / Opportunity

Early roll out of 5G is likely to be in those areas where mobile data use is most congested such as the Regional Centre.

#### Response

5G needs access to full fibre, therefore the roll out of full fibre will need this to underpin this. GMCA and the Districts, in conjunction with the digital and telecom providers, need drive forward opportunities to promote connectivity and uptake in the regional centre.

They need to continue to liaise with national bodies to capitalise on the opportunities that a high density urban areas offers; for example, Vodafone's present trial of a 5G pilot in Salford Quays.

#### Stakeholders

**GMCA, the Districts and the infrastructure providers**

**Challenge 2, 3, 9, 10 and 11 refer to Greater Manchester Framework (page 36 - 43)**





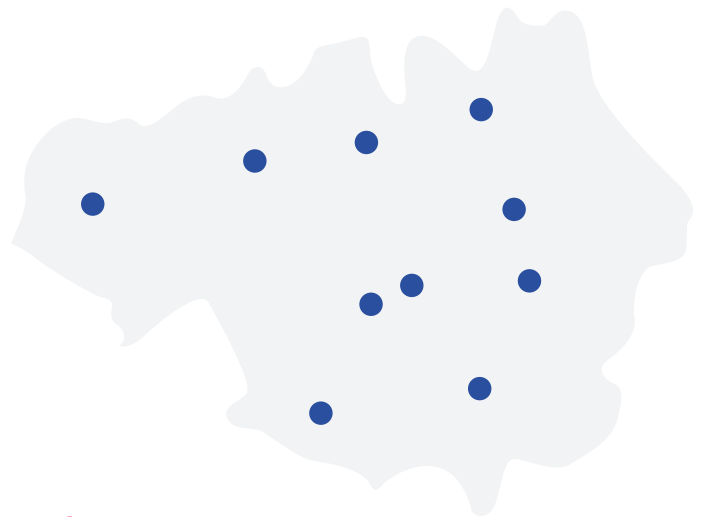
## Towns

There are ten main towns and associated Local Authorities (aka. the Districts) within Greater Manchester. These towns and their centres are facing challenges as their traditional functions and contribution to the GM economy are in decline. This is due to a number of factors including the on-going growth of internet shopping and large out-of-town retailers, office spaces and leisure facilities. Recognising this, GM are developing a series of strategic interventions (including the Town Centre challenge strategy) to support Greater Manchester's local authorities to realise the potential in town centres, with a particular emphasis on achieving sustainable communities featuring thriving housing markets<sup>9</sup>.

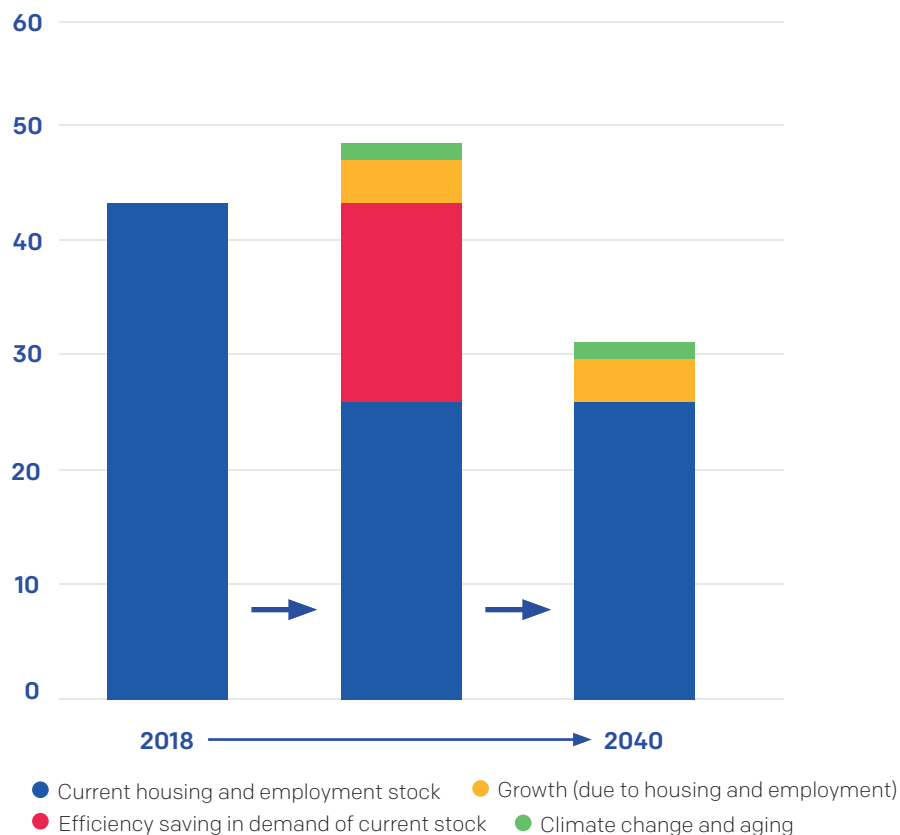
Looking towards the future, the role of these main towns as local economic drivers will be developed further, building on their good public transport linkages, to provide the primary focus for economic, retail, leisure and cultural activity in their surrounding areas. There is an aim to focus on local regeneration and promote housing growth in these areas, maximising them as residential centres, and spreading growth out of the City Centre.

### Impacts:

For the purposes of considering the potential changes in demands for heat, electricity and potable water supplies, a nominal town with a population of 50,000 has been considered. Growth has been assumed in-line with that of Greater Manchester.



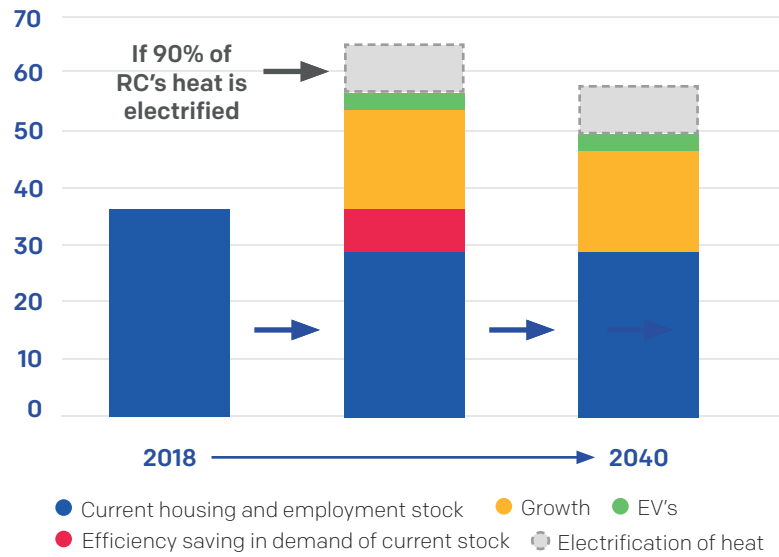
**Heat Demand**  
**GM Town Centre Peak Heat Demand (MW)**



9. [https://www.greatermanchester-ca.gov.uk/news/article/265/mayor\\_s\\_town\\_centre\\_challenge\\_marks\\_major\\_milestone\\_as\\_new\\_locations\\_revealed](https://www.greatermanchester-ca.gov.uk/news/article/265/mayor_s_town_centre_challenge_marks_major_milestone_as_new_locations_revealed)

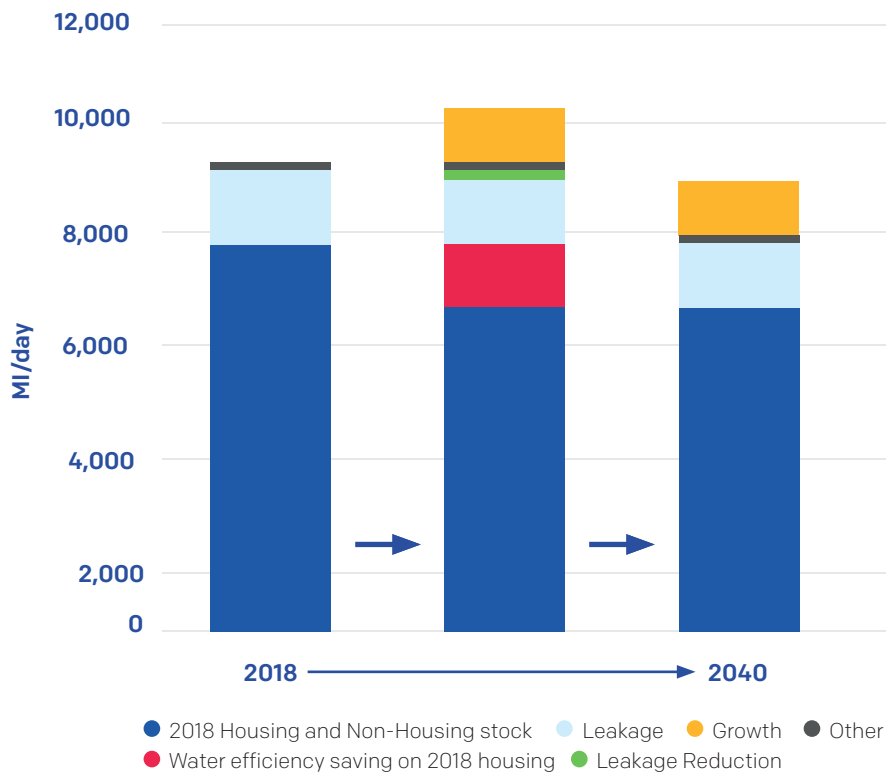
## Electricity Demand

### Town Peak Electricity Demand (MW)



## Potable Water

### Town Centre





## Towns Framework

The Towns Framework only addresses aspects where the required response to the challenges is different from the overarching GM Framework. The Town Centre Challenge, and associated developments should refer to both frameworks in the development of any future proposals or masterplans.

### Key Challenge 4: Capacity, connectivity and diversity of the transport networks

#### Local Challenge / Opportunity

Increasing density of people within the towns is an opportunity to provoke a shift in the use of streets from cars to people and active travel (such as beelines).

#### Response

Any regeneration or development proposals within Towns should provide access for non-car modes and create a high, quality environment for visitors, workers and residents to enjoy.

Opportunities to improved connectivity between town centres should be explored where possible.

#### Stakeholders

**GMCA, the Ten Districts and TfGM**

**GMCA, the Ten Districts and TfGM**

### Challenge 6: Flood risk

#### Local Challenge / Opportunity

Incremental development (e.g. schemes under permitted development and the gradual paving of front and back gardens) creating challenges associated with increased surface water run-off and reducing green infrastructure.

#### Response

GMCA, the Ten Districts and the EA need to review and consider this within the wider context and policy associated with flood risk.

#### Stakeholders

**GMCA, the Ten Districts and the EA**

### Challenge 7: Green and blue infrastructure

#### Local Challenge / Opportunity

Industrial heritage of towns typically means that existing development is not as well integrated with blue and green infrastructure.

#### Response

GMCA, the Ten Districts, the EA and UU should consider opportunities to reconnect to and enhance the green and blue infrastructure in these locations e.g. de-culverting or re-wilding schemes along local watercourses. Opportunities should be sought to develop green and blue corridors connecting the towns to the wider region and externally of Greater Manchester. It is recommended Districts develop Local Green and Blue Strategies to develop and move forward these aspirations.

#### Stakeholders

**GMCA and the Ten Districts**



## Key Challenge 9: Collaborative and co-ordinated approach

### Local Challenge / Opportunity

Our town centres are facing serious challenges over the coming decades as a result of changing markets and consumer habits. In recognition of this, GM has launched the Town Centre Challenge – an ambitious new initiative to regenerate urban centres across Greater Manchester.

### Response

Infrastructure providers will need to be aware of how they can support town centre aspirations and the changing demands associated. Early and on-going communication between Local Authorities and Infrastructure providers will be essential in achieving these ambitions.

### Stakeholders

**Ten districts of GM and the infrastructure providers**

Challenge 1, 2, 3, 5, 8, 10 and 11 refer to Greater Manchester Framework (page 36 - 43)

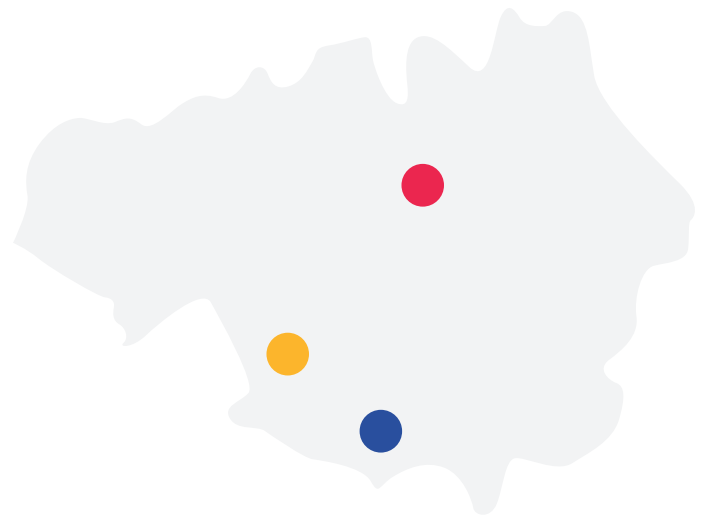
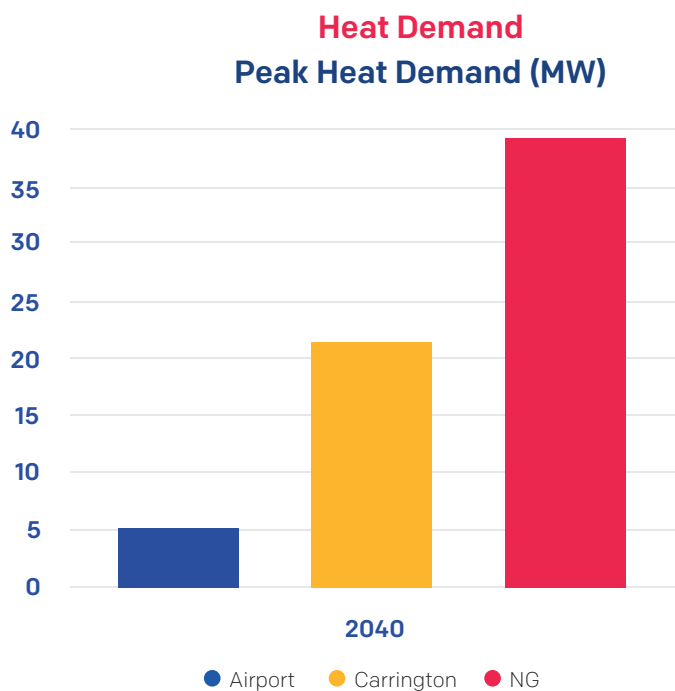
## New hubs of development

The Greater Manchester Spatial Framework identifies a number of new areas of development across the region of Greater Manchester. These allocations of land will look to support the growth of Greater Manchester outside of the Regional Centres and Towns.

At present, these development sites are likely to have limited infrastructure provision, beyond that of the neighbouring developments. Careful and holistic consideration of the demand implications on local infrastructure provision will need to be undertaken to avoid network issues. These areas may require new connections and localised reinforcements / upgrades, which should be considered whilst looking ahead to the future envisioned landscape of Greater Manchester.

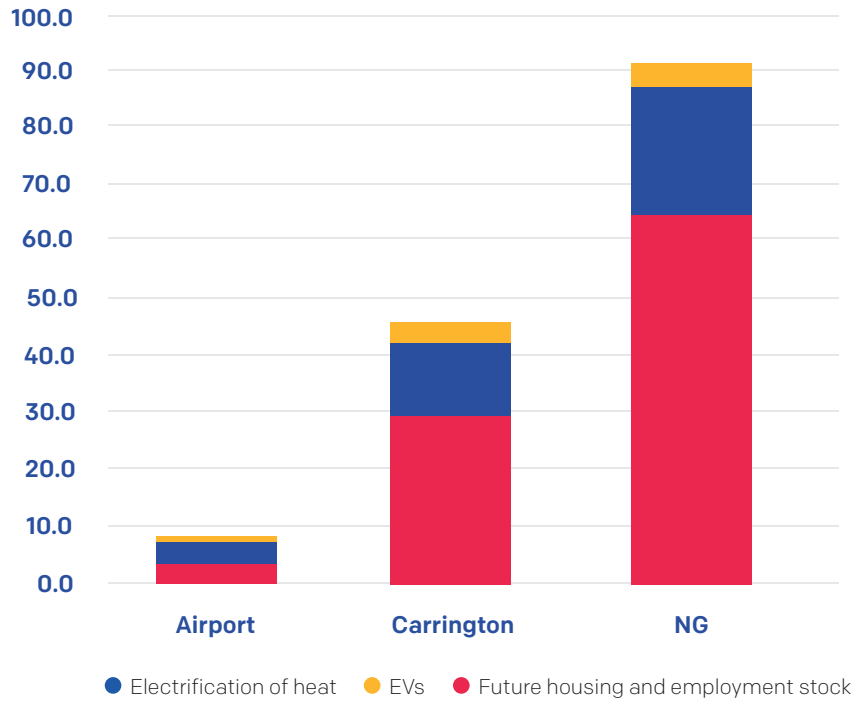
For the purposes of considering the impacts of change on the infrastructure and developing a high-level framework, three locations have been considered:

- **Airport Gateway** - Provides a unique combination of outstanding international connections and excellent public transport access. The Manchester Airport City Enterprise Zone will aim to offer a range of high quality development opportunities in an area of high market demand.
- **Carrington** - Within the proposed Western Gateway, involves the major redevelopment of the former Shell refinery in Carrington. Proposals include a large residential scheme, with a combination of industrial, employment and retail space.
- **Northern Gateway** - Covers a stretch of the M62 corridor around its intersection with the M66. It provides a unique opportunity to enhance the economic role of the northern and eastern parts of GM and significantly increase the supply of new housing.

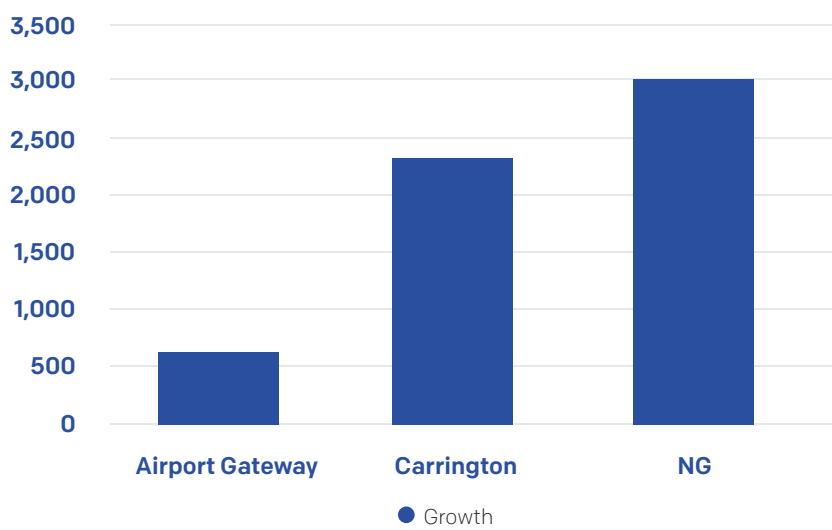


**The Greater Manchester Spatial Framework is a joint plan for Greater Manchester that will allocate land for jobs and new homes across the city region. The framework, which is being produced by the 10 councils working together in partnership, will try to make the right places to deliver the homes and jobs needed up to 2035.**

### Electricity Demand Peak Electricity Demand (MW)



### Potable Water Growth Areas



**Observation:** Northern Gateway's indicative demand is half of a town of 50,000 people.

## New Hubs of Development

The New Hubs of Development Framework only addresses aspects where the required response to the challenges is different from the overarching GM Framework. Readers should refer to both frameworks in the development of any future proposals or masterplans within these locations.

### Key Challenge 1: Infrastructure for low/zero carbon heat

#### Local Challenge / Opportunity

These new areas of major developments are in areas that will not have much of an existing infrastructure.

#### Response

They will typically be built out over a number of years, and thus recognising as discussed above that future heat options are not clear, each development should consider their particular energy future, and provide flexibility to accommodate that future.

It is currently likely that this will include high standards of building insulation, provision of heat networks in areas of dense development, and provision for air or ground source heating in areas of less dense development.

The newer low carbon heating approaches may be more expensive than approaches compatible with current buildings regulations. GM should therefore explore with stakeholders how the installation of low and zero carbon heating can be made economically advantageous for the site developers in order to add to the evidence base for this growing technology and avoid fixing in more high carbon heating in GM.

GM should also evaluate the potential for one or more of these areas to act as a trial area for the roll out of 100% hydrogen to properties for heating. As identified in GMIF Key Challenge 1 and linking with the NIC's recommendation, the new hubs of development are likely to be best placed to host this pilot.

#### Stakeholders

**Developers, GMCA and the Ten Districts**

**GMCA, the Ten Districts and stakeholders**

**GMCA, the Ten Districts, NIC and Cadent**



### Key Challenge 3: Electrical infrastructure able to accommodate local renewable generation, rapid electric vehicle charging and, potentially, the electrification of heat

#### Local Challenge / Opportunity

These are areas of new development, with opportunities to develop new masterplans.

#### Response

These areas have significant potential for the implementation of local renewable generation, the extent of which should be determined by GM and its need for low carbon generation. A number of these developments, their associated master-planning and constructions phases will be starting the next couple of years, GMCA and the Districts must not miss opportunities to incorporate the necessary infrastructure to support a zero carbon future.

The future necessary changes needed to the electrical distribution grid have not been trialled at a large scale. These new build areas may provide the opportunity for larger scale trials. GM, developers and ENWL should work together assess how early implementation of smart technologies, including battery storage can be implemented in these areas.

#### Stakeholders

**GMCA, the Ten Districts**

**GMCA, the Ten Districts, developers and ENWL**

### Key Challenge 4: Capacity, connectivity and diversity of the transport networks

#### Local Challenge / Opportunity

New developments may require significant new or enhanced transport infrastructure to support connectivity to the wider City Region.

#### Response

Capacity and connectivity of local transport facilities should be considered during site allocation and proposal development, with close co-ordination with TfGM and local highway authority. Sites should be located where sustainable transport options are in place or can be delivered in future.

Master-planners should incorporate measures to support and promote active travel – e.g. walking and cycling infrastructure.

#### Stakeholders

**GMCA, the Ten Districts and TfGM**

**Developers**

### Key Challenge 5: Infrastructure to support ultra-low emission vehicles

#### Local Challenge / Opportunity

These are areas of new development, with opportunities to develop new masterplans.

#### Response

Determination of how to best ready these new sites for EVs and alternative technologies, providing flexibility within the approach without prohibiting development or installing abortive technology.

#### Stakeholders

**GMCA, Ten Districts and TfGM**

## Challenge 6: Flood risk

### Local Challenge / Opportunity

Scale of some of the site allocations may require consideration of flood mitigation measures beyond the site boundaries.

#### Response

Where the new development hubs are taken forward at more suburban scales of density, opportunities should be taken for more natural approaches to drainage and flood management.

Where appropriate, solutions should be explored at a catchment level, where the new development areas could make a larger contribution to flood risk reduction than just within their footprint, particularly where they are upstream of the city region or other existing developments. GM and the EA should look to bring schemes and funding together in coordination to exploit such opportunities.

#### Stakeholders

**GMCA, the Ten Districts and the EA**

**GMCA, the Ten Districts and the EA**

## Challenge 7: Green and blue infrastructure

### Local Challenge / Opportunity

Sites located on existing green and blue infrastructure.

#### Response

Opportunities to implement and enhance green and blue infrastructure from the master-planning stage of the new development hubs must be taken, and the implementation of these proposals must be sustained through the build out of the development.

Schemes need to carefully consider the long-term maintenance and management of green and blue infrastructure and ensure that the resourcing and delivery of this maintenance is commercially and organisationally secured. This needs to be considered from the project inception.

GM and the districts should explore the potential for these new development areas to trial a Net Environmental Gain approach to development.

#### Stakeholders

**GM, the Ten Districts and the Developers**

**Developers**

**GMCA, the Ten Districts and the Developers**

## Key Challenge 9: Collaborative and co-ordinated approach

### Local Challenge / Opportunity

New sites provide opportunity for new and innovative approaches.

#### Response

GMCA and the Infrastructure Providers need to consider how the provision of significant new future proofed infrastructure for these areas can help support the wider needs of GM, including consideration of the financial contributions of customers, infrastructure providers, house buildings and developers can be coordinated.

Ensure new infrastructure is future proofed may require funding and financing beyond the business as usual approach. GMCA, the Ten Districts and the Infrastructure providers need to consider and develop alternative mechanisms to support these developments.

#### Stakeholders

**GMCA, the Ten Districts, and the Infrastructure Providers**

**GMCA, the Ten Districts, and the Infrastructure Providers**

**Challenge 2, 8, 10 and 11 refer to Greater Manchester Framework (page 36 - 43)**

