



London Infrastructure Framework

Building London's sustainable, inclusive future

Executive summary

London's infrastructure framework is designed to identify and advance projects and programmes that support London's economic framework, which sets out a vision for an inclusive and sustainable future. It aims to unlock short-term opportunities to drive regeneration, whilst also laying the groundwork for a more long-term approach which builds capacity to deliver infrastructure that supports inclusive economic growth across the capital. The framework embeds sustainability as a core aim, looking to highlight and encourage interventions that contribute to London's climate resilience and decarbonisation.

Infrastructure is central to London's ambition to develop a more inclusive and sustainable future by providing for today's residents and businesses and unlocking future development opportunities. Bringing together the major projects that can support both London and the UK to achieve clean and inclusive growth is an important step, as is building the local capacity needed to advance strategic infrastructure design and delivery.

London boroughs have come together to create this framework for mapping and prioritising infrastructure across London; the framework has also been informed by discussions with the Greater London Authority and Transport for London, and is broadly aligned with their strategies, though its primary aim is to reflect and capture the views of London Councils and boroughs. This means that partners across the capital can speak with a more united voice to investors and to Government about regional priorities, specific opportunities, and how development will empower London's long-term economic vision. Both London Councils and the GLA have expressed the intention to undertake the next major review of the framework jointly, which would strengthen the capital's voice even further.

Drivers of strategic infrastructure

The framework reflects the six infrastructure categories covered by the National Infrastructure Commission: transport, energy, waste, water and wastewater, flood risk management, and digital communications. It summarises key trends impacting infrastructure provision and demand across London and within its Sub-Regional Partnerships: a shifting economic geography, inequality and the need for inclusive growth as the city develops further, mitigating the impacts of climate change, and proactively facilitating the Net Zero transition by managing local energy supply and demand.

London's existing transport infrastructure is world class, and a major asset in decarbonising the city, but it needs maintenance and investment. Infrastructure interventions in general are provided by local, regional, and national organisations, and infrastructure is owned and managed by a range of public and private organisations. This complexity causes fragmentation, particularly considering the range of types of interventions needed to maintain, adapt, and provide new infrastructure. Moreover, London needs major new infrastructure investment to support the emergence of a more polycentric model of economic growth, to connect disadvantaged communities to economic opportunities, and to empower the Net Zero transition.

Strategic infrastructure investment is also needed to unlock the economic, social, and environmental potential of regeneration projects, innovation clusters, and opportunity areas across the capital. These create local benefits in the form of high quality homes and jobs, and also help the UK economic grow faster at a time when this is a national imperative.

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The case for strategic infrastructure

Infrastructure investment in London can kickstart national growth and accelerate the Net Zero transition. It is critical to productivity growth, the challenge that sits at the heart of Britain's growth problem; London itself has seen a marked slowdown in productivity growth since the financial crash, compounded by the initial effects of Brexit and the rapid acceleration of long-term trends in the decline of retail and office working that were brought about by Covid lockdowns. London must also address its notable social and spatial inequalities, as well as mitigating the consequences of extreme temperatures and weather events as a result of climate change. It must maintain its status as a competitive, global city.

London developed a new economic framework in light of these challenges, and identified the role for infrastructure investment in supporting inclusive and sustainable renewal. This requires new ways of working for a city that until recently has seen steady growth for the last three decades. London must also play its part in supporting Levelling Up, whilst recognising that this national priority has real effects for investment available in the capital.

The case is clear for investing in infrastructure in London in order to boost regional and national economic growth, but the funding for this will need to be driven locally and regionally rather than national. To make this possible, London will need to have greater flexibility and control over the proceeds of future growth in order to bolster its ability to promote inclusive and sustainable growth without overreliance on the national exchequer. This will also require the London system to work together to a greater degree, as it has already begun to in responding to Covid-19 and in developing the London Economic Framework.

Taking into account assessment of infrastructure needs and London's economic ambition, the framework sets out six strategic priorities for infrastructure:



The infrastructure framework

The infrastructure framework itself for the first time brings together and maps infrastructure projects and programmes from boroughs across the capital and assesses them based on the strategic criteria set out above. 180 projects were collated and reviewed, with 67 identified as relevant to the framework at present. These were further categorised across the

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following four groups in order to articulate their scale and their relationship to the strategic priorities:



Potential to create meaningful socioeconomic impact

Contributing towards London's decarbonisation and Net Zero transition

This is a point-in-time reflection and, critically, there both *are* and *will be* more projects involved in delivering on the vision of London's inclusive and sustainable future. There are important geographical gaps in strategic activity, and at present projects related to decarbonisation, local energy generation, and flood risk do not reflect the significant pressures faced across the capital and its ambitious targets around climate change. The framework will be maintained and updated by London Councils over time to include new projects and reflect changes to their stages of development.

The structure and the specific projects identified in the framework amount to a meaningful resource to be used by London Councils, by Sub-Regional Partnerships, and by Boroughs in engagement with Government and with investors. Each category of projects can be deployed both strategically and tactically, for instance in discussion and negotiation with prospective partners at investor and policy events.

Delivering infrastructure for the future

Meeting London's future challenges and opportunities will require cutting-edge and adaptable infrastructure solutions. Existing infrastructure must be upgraded to improve energy efficiency, increase resilience to sudden shocks and long-term stresses, and reduce emissions. New infrastructure must balance deliverability and accessibility with ambition and growth; delivery models must keep pace with opportunities to advance strategic priorities.

Novel and innovative funding and delivery mechanisms will be required to meet London's future infrastructure needs. The infrastructure framework does not present a formal funding strategy because the types of projects included are too varied and complex for single approach to funding. Instead, it outlines a range of funding and finance options that could unlock private investment and improve London's self-sufficiency.

London already has examples of innovative working to deliver infrastructure requirements. 3Ci¹ is building a national business case for a neighbourhood model of delivering housing retrofit requirements, and the Mayor of London has established a green bond to raise £500m of capital to invest in decarbonisation and other climate related projects in London.

¹ The 3Ci initiative, co-founded by London Councils alongside Core Cities UK and Connected Places Catapult, exists to find investable solutions for achieving Net Zero and has been developing a national pipeline of projects. A significant number of the included schemes are from London boroughs. However, analysis has shown that many are still in early development stages and delivery plans still need considerable investment.

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The development of the framework also involved a roundtable with investors and discussions with the BusinessLDN working group on private investment in infrastructure. It is clear that whilst there is strong interest in a range of infrastructure investment opportunities across London, many opportunities need public sector leadership and de-risking in order to be viable. That requires more investable projects, more appetite for risk, and more collaboration to create projects and capacity at the right scale. Fundamentally, it also requires greater fiscal devolution to London, in order to broker investment based on longer-term funding certainty and the ability to deploy funding streams linked to future growth.

Not only does London have less fiscal flexibility and autonomy than its global competitors, but it is also being left behind in the devolution process compared with other UK city-regions. The Trailblazer Devolution Deals for Greater Manchester and the West Midlands and the progress of devolution to the other Mayoral Combined Authorities are welcome developments as the next phase in fiscal devolution to places; but whilst London was the starting point for this process two decades ago, TfL now has far less funding certainty than other city-region transport bodies, and London leaders have fewer levers, and less fiscal flexibility, than other civic leaders across the country.

To develop and deliver on a new deal for London, and to activate transformational infrastructure investment, will mean building on the collaboration that has been established in recent years across London boroughs and with the GLA, based on guiding principles set out in the framework.

- A consensus-led approach should enable solutions and interventions that benefit all of London**, even if not necessarily at the same points in time.
- Pan-London collaboration** should support parts of London with less capacity to meet the long-term vision of a thriving and polycentric economic geography.
- Shared governance and accountability across London**, evolving economic governance so that it continues to lead and co-ordinate impactful investment.
- London should become increasingly self-sufficient**, with skills and flexibilities to progress strategic priorities even in a constrained public funding environment.
- Fit-for-purpose solutions should be developed and applied to strategic infrastructure interventions** from a practical toolkit of potential supports.
- Risk should be shared across a number of partners**, and borne by the institutions best set up to manage it, rather than a single authority or provider.
- Long term strategic public private partnerships should create opportunities to optimise socioeconomic and environmental outcomes** over time.

To deliver the investment that can help generate inclusive and sustainable growth for London and the UK, a new devolution and fiscal settlement is needed. This could build on and further develop the deals with Mayoral Combined Authorities as well as drawing on the ideas and principles set out in the London Finance Commission. This should be about longer-term funding certainty and enabling London to have greater control and flexibility over the proceeds of future growth. Enabling London leaders to utilise mechanisms like land value capture, tax increment financing, and business rate retention will enhance London's self-sufficiency and complement Levelling Up investment elsewhere.

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The framework concludes with three core recommendations that will support London to expand its capacity, capability, and coordination to deliver strategic infrastructure investment that supports the vision of sustainable and inclusive economic growth for the capital.

Infrastructure Delivery Skills Hub

London should develop a central infrastructure development and delivery skills hub, bringing together GLA and London Councils capacity to share specialist knowledge across London.

Devolved Growth & Investment Deal

London should develop a new growth, investment and devolution deal with a gainshare principle based on London generating a higher rate of growth for the UK, in return for being able to retain and invest more of the proceeds of locally driven growth.

Specialist Delivery Vehicles

A range of partnership and delivery vehicles to create shared capacity and capabilities around specific infrastructure challenges and opportunities facing London.

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Annex A: Project Descriptions

1 Introduction

London is one of the world’s great cities, a core part of the United Kingdom’s identity, and a global economic and cultural centre. The city’s vast economic footprint does not, however, make it immune to the challenges and barriers to achieving inclusive and sustainable economic growth. In 2023, the UK is in a period of economic downturn, with output still not having returned to pre-pandemic levels.

London, which has been the main driver for UK growth over several decades, will have to overcome several challenges if it is to continue to play a leading role. It has become increasingly expensive to live and work in London, creating challenges for the city’s residents as well as businesses that operate here. Delivering major development projects is more expensive than ever, and government and investor capacity is not only constrained but also looking outside the capital more than ever before.

The London economic framework,² originally developed in response to Covid-19, focuses on London’s long-term economic growth, addressing prolonged structural inequalities and building coordinated activity to support a resilient, inclusive, and sustainable path forward. The economic framework sets out shared ambitions and opportunities for collaboration across five key pillars of activity (figure 1).

Figure 1 London’s economic framework (updated December 2022)



Adapted from London’s Economic Framework

However, the development of the economic framework highlighted a lack of coordinated activity to ensure strategic infrastructure projects could be presented on a pan-London basis to investors and to Government. The London infrastructure framework is therefore intended to set out the role of infrastructure in enabling the delivery of London’s long-term vision, whilst also activating development opportunities to stimulate economic growth in the near-term.

The infrastructure framework was developed with the support of Metro Dynamics and input from 31ten Consulting in Winter 2022-2023. Extensive engagement across the London system supported its development, including with Leaders and Mayors from all boroughs; officers from London boroughs, the Greater London Authority, and Sub-Regional

² London Councils (2021), [An Economic Framework for London](#).

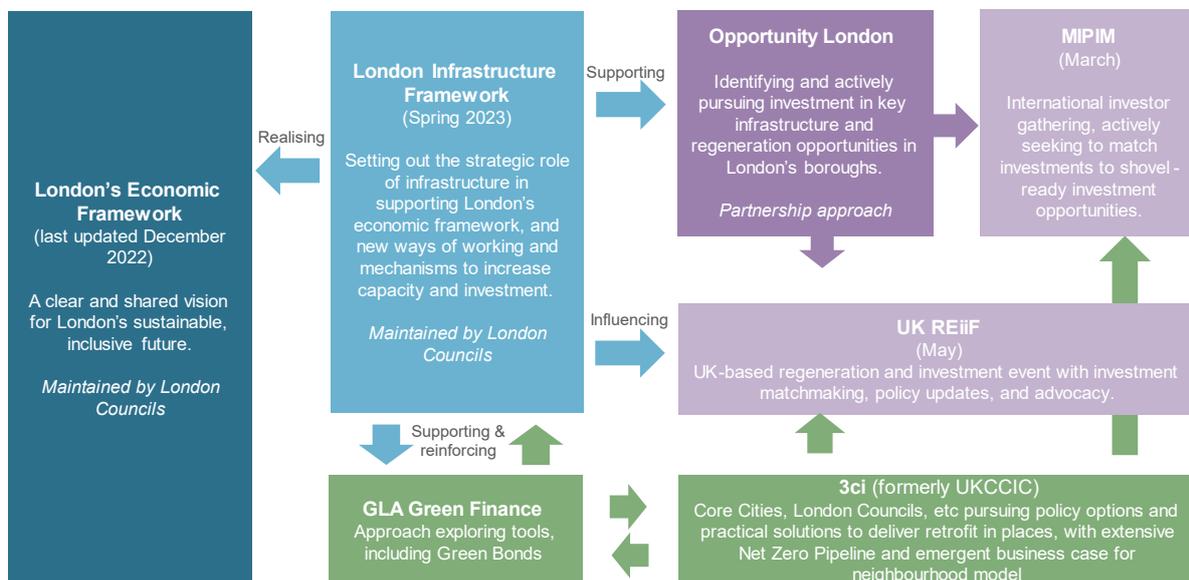
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Partnerships; regulated infrastructure providers including Transport for London and Thames Water; and private and institutional investors. This informed the strategic considerations and priorities within the framework; and an extensive call for projects supported assessment of relevant existing and planned infrastructure interventions.

London Councils will be responsible for the ongoing maintenance and updating of the framework, which will act as a tool available to organisations working across the London system to articulate the strategic nature of key infrastructure projects, to build towards more strategic capacity, and to support further aspiration around the role of infrastructure in supporting London’s sustainable and inclusive growth. This will include keeping the specific projects referenced up to date and adding new projects as they emerge over time, as well as taking forward strategic recommendations designed to support increased capacity, capability, and coordination. Both London Councils and the GLA have expressed the intention to undertake the next major review of the framework jointly, which would strengthen the capital’s ability to speak with a united voice.

The framework reflects a point-in-time assessment of current and planned strategic infrastructure projects, and also sets out a more strategic approach to conceptualising, developing and delivering projects going forward. This will form the basis of future material developed by Opportunity London³ alongside wider development and marketing opportunities. The framework also sets out specific operational and policy interventions that could help unlock a more strategic approach to infrastructure provision in the future, which can be taken forward and advocated for in forums like UK REiiF and LREF.

Figure 2 Relationships between strategic frameworks and initiatives



In developing the framework, London is resetting how it thinks about the future, looking to increase its capacity to leverage its reputation, investment, and assets to continue to grow its economy in a more inclusive, self-sufficient, and sustainable way. Partners across the London ecosystem are looking to improve how they work together, improve infrastructure

³ <https://opportunity.london/>

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delivery, and strengthen the relationship between physical development and inclusive economic opportunity.

Figure 3 Infrastructure definition

<p>Transport</p> <p>Providing intermodal physical connectivity between places, including passenger transit and logistics, pipelines and terminals, as well as EV charging.</p>	<p>Energy</p> <p>Enabling the direction and management of energy from production to consumption, increasingly including local demand and supply systems.</p>	<p>Waste</p> <p>Collecting, storing and managing waste through various mechanisms including landfill, treatment, recycling, and composting.</p>
<p>Water and wastewater</p> <p>The movement and treatment of water, including drinking water, stormwater and wastewater.</p>	<p>Flood risk management</p> <p>Managing water retention, flood plain storage, and flood defences.</p>	<p>Digital communications</p> <p>The use of data and computerised devices, including internet, broadband, and mobile networks.</p>

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The types of infrastructure covered by the framework align with the National Infrastructure Commission definition, which covers physical and enabling infrastructure (figure 3). The framework considers both renewal projects and new infrastructure – the maintenance of existing infrastructure being of equal importance to developing new solutions in terms of securing and expanding economic opportunity.

Fundamentally, the framework embeds sustainability as a core aim: building London’s resilience to climate change while also decreasing its negative environmental impacts. This means that now and in the future, projects considered in the infrastructure framework must reflect their role in London’s net zero journey, with adaptation and longevity critical considerations in project design.

The remainder of the report covers:

- Section 2.** Key trends and drivers affecting infrastructure in London.
- Section 3.** The case for infrastructure as a driver of inclusive economic growth, and the current landscape of responsibilities in infrastructure delivery.
- Section 4.** The strategic infrastructure framework and point in time assessment of relevant projects.
- Section 5.** The role for innovation in infrastructure delivery, particularly considering funding and delivery models.
- Section 6.** A new approach to integrated working on strategic infrastructure.

2 Trends and drivers affecting infrastructure

A clear understanding of the economic and environmental trends facing London is essential to building a more strategic, long-term approach to infrastructure provision. This section covers London-wide trends, as well as more specific sub-regional infrastructure pressures and priorities within the capital.

London-wide infrastructure trends

London is one of the biggest cities in Europe, home to 8.8m people with millions more commuting and visiting every day. These people all rely on the city's infrastructure. Through its history London has been a leader in urban infrastructure; its ambition and innovation in this area has been a foundation of the city's growth and success.

However, the recent evolution of the city has created new opportunities and pressures for boroughs. It will be vital to keep pace with shifting demand and environmental constraints by maintaining and modernising existing infrastructure, whilst also looking proactively towards the future with ambitious new schemes and interventions.

This section explores some of the major trends and drivers affecting infrastructure in London. These reflect the themes identified in the 2018 National Infrastructure Assessment⁴, which will be refreshed later in 2023.

Managing the implications of growth

In 2023, London's population and economy continue to grow, but its infrastructure is under increasing strain. Between 2011 and 2021 London's population grew from 8.3m to 8.8m residents⁵ and GLA projections estimate the **population will increase by 600,000 residents by 2030**.⁶ With this increase it is important to consider the implications on the existing inequalities across London, where the bottom 50% of households only account for 5% of wealth and for many of the poorest households, their debts outweigh their assets.⁷ Many of these householders were severely affected by the pandemic, and again by the cost of living crisis.

The pressures of a growing population also play out differently across the capital, with different parts of greater London projected to experience concentrated population growth than those that have in the past (figure 4). Infrastructure and development need to both keep pace with and anticipate the demand for services that will grow alongside the population, and enable all of London and its communities to benefit from economic opportunities, high quality placemaking and connectivity, and environmentally sustainable assets.

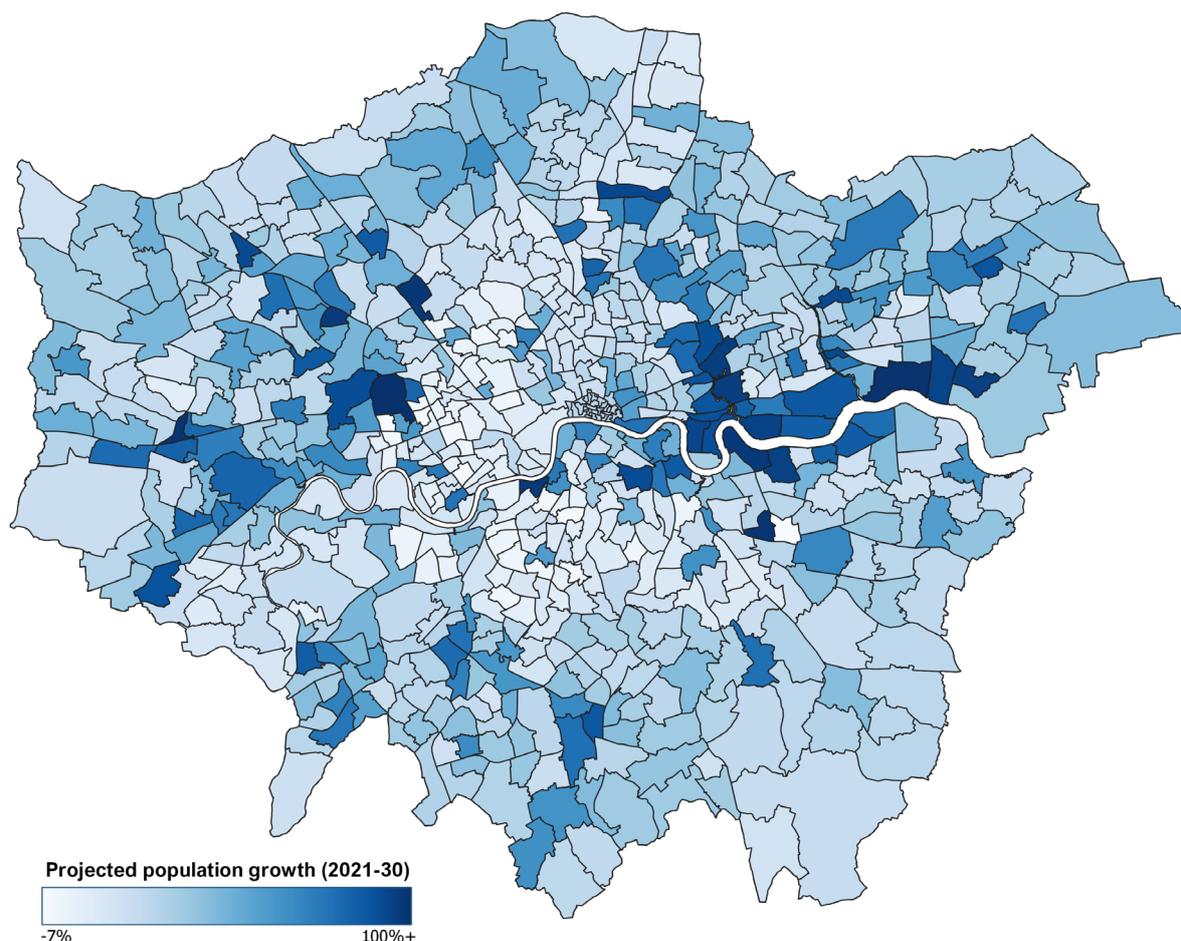
⁴ National Infrastructure Assessments identify at a national level how the infrastructure needs and priorities of the country should be addressed. National Infrastructure Commission (2018). [National Infrastructure Assessment](#).

⁵ ONS (2021), Census 2021, Population and household estimates.

⁶ GLA (2021), 2020-based population projections.

⁷ GLA (2021), Wealth inequality

Figure 4 Population growth projections by ward, 2021-2030



Source: Metro Dynamics analysis of Housing-led population projections. Greater London Authority, 2023

London's business population is also growing. London's total business population (including small, unregistered businesses) at the start of 2022 was 1,038,00, 44% higher than in 2010.⁸ Emerging sectors are growing in the city as London provides an ideal environment for new technology businesses, ranked as the 5th best city in the world for attracting venture capital across a range of tech sectors.⁹

Innovation and business activity are vital to London's ongoing economic success, generating jobs and investment that power the region's economy. Productivity growth is vital to the UK's recovery from Covid-19 and to maintaining its global position post-EU exit. London will be key to this, containing a majority of subregions with productivity above the UK average.¹⁰

However, successful companies require high-speed, secure digital connectivity alongside supporting facilities like data centres, which have large energy demands. Currently, London

⁸ BEIS (2022), Business population estimates.

⁹ Savills (2023), Savills tech cities 2023.

¹⁰ ONS (2022), Subregional productivity in the UK.

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is only ranked at 76th internationally for broadband speed¹¹ and has already been grappling with energy supply pressures. While the continued success of tech in London is crucial for its future growth, the rise of high-tech businesses is putting increasing pressure on the city's digital infrastructure. Addressing these issues will be essential in supporting the continued growth of these businesses and in maintaining London's competitiveness as a global city.

Population and business growth directly increase transport and road congestion, one of the major pressures already felt across the city. Studies have found drivers in London spend more time stuck in traffic than in any other city in the world; **in 2022 drivers spent an average of 156 hours stuck in traffic, 5% more than pre-pandemic.**¹² Road transport accounts for 28% of London's carbon emissions and air pollution as travel and the demand of services increases¹³.

The planned Ultra Low Emission Zone expansion looks to address this, the existing ULEZ having facilitated an almost 50% reduction in nitrogen dioxide pollution in central London since 2016. The expansion aims to reduce road congestion in outer London boroughs by leading to 146,000 fewer car trips being taken and in turn reducing harmful emissions. However, some boroughs have expressed concerns that expanding ULEZ into areas with poor alternatives to private car usage could have other adverse economic and social impacts, illustrating the need for sustainable transport infrastructure interventions to keep pace, particularly in parts of London that have not historically benefitted from a high degree of public transport connectivity.

A shifting economic geography

London itself has a significant geographical footprint, and a high degree of physical and economic connectivity to its surrounding regions. The capital's economic geography, the balance of places within the conurbation where economic and other activity takes place, has been evolving as a result of trends that were rapidly accelerated by the economic shock that accompanied the Covid-19 pandemic.

The 2021 Census found that outer London's population had grown at almost twice the rate of inner London over the past decade. The rise of hybrid working and the birth of new dynamic businesses have put new pressures on areas previously unaccustomed to supporting a workforce at home. Demands on digital, waste, and energy infrastructure have greatly increased, while roads became busier with the increased demand for delivery services. At the same time, commuter requirements of public transport are still and gradually recovering since the pandemic, with many parts of the network under significant strain as a result. The ways in which workers and residents move around the city have changed, but continued investment in London's connectivity will be vital to meeting the capital's future needs.

The initial decline of footfall and a shift in public transport usage have challenged assumptions around the role of the Central Activities Zone while laying the groundwork for structural shifts in how and where the regional workforce operates (figure 5). Over the last few years, London has had to adapt as Covid forced businesses to accelerate digitisation

¹¹ Speedtest (2023), Speedtest global index: median city speeds.

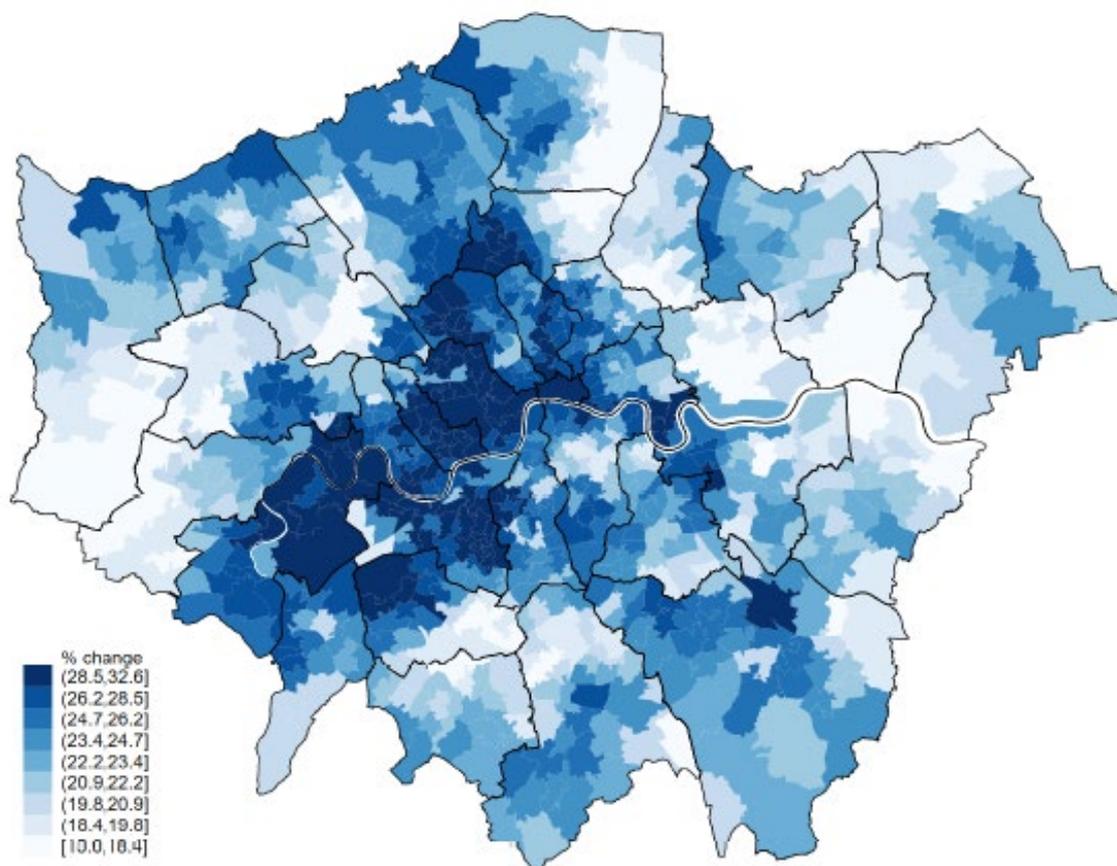
¹² Inrix (2022), Global Traffic Scorecard.

¹³ London Assembly (2023), [The Ultra Low Emission Zone for London](#).

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and adopted hybrid working, which in turn impacted where services, amenities, and people are located.

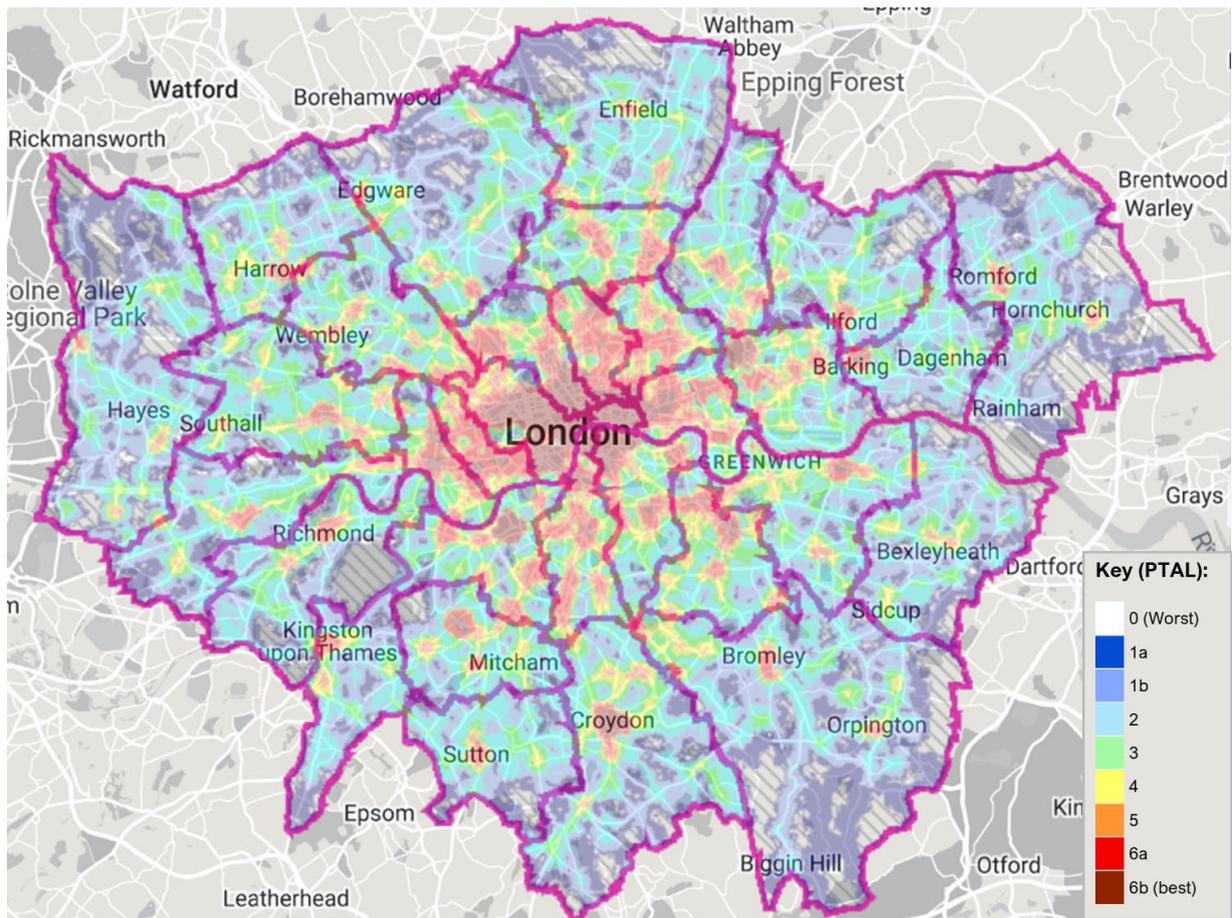
Figure 5 Percentage change of remote working in 2022 vs 2019



Change in number of residents working remotely in 2022 over 2019 as a percentage of total neighbourhood workforce. Source: University of Sheffield (2021), Covid reallocation of spending: The effect of remote working on the retail and hospitality sector

The newly reshaped city needs a wider network and more orbital transport connectivity to provide for these new demands. As the city continues to expand, major developments in new parts of the city will increase demand for new routes (and more capacity on existing routes) and continue to put greater pressure on transport infrastructure. It will also mean expanding quality public transport provision to parts of the capital that have not always benefitted, particularly in outer London; current public transport provision is illustrated in figure 6, which shows parts of the city rated by distance from frequent public transport services. The Public Transport Availability Level score ranges from 0 (the worst availability) to 6b (the best availability, coloured red).

Figure 6 Distance from frequent public transport service (2021 forecast)



Source: TfL [WebCAT](#) planning tool, measurement of locations by distance from frequent public transport services.

Climate change

Climate change is already altering weather patterns, with London experiencing an increase in extreme events from higher seasonal rainfall to over 40°C summers, both of which have impacted the operation of its infrastructure. London must adapt to these extremes, whilst also mitigating further contributions towards carbon emissions and climate impact.

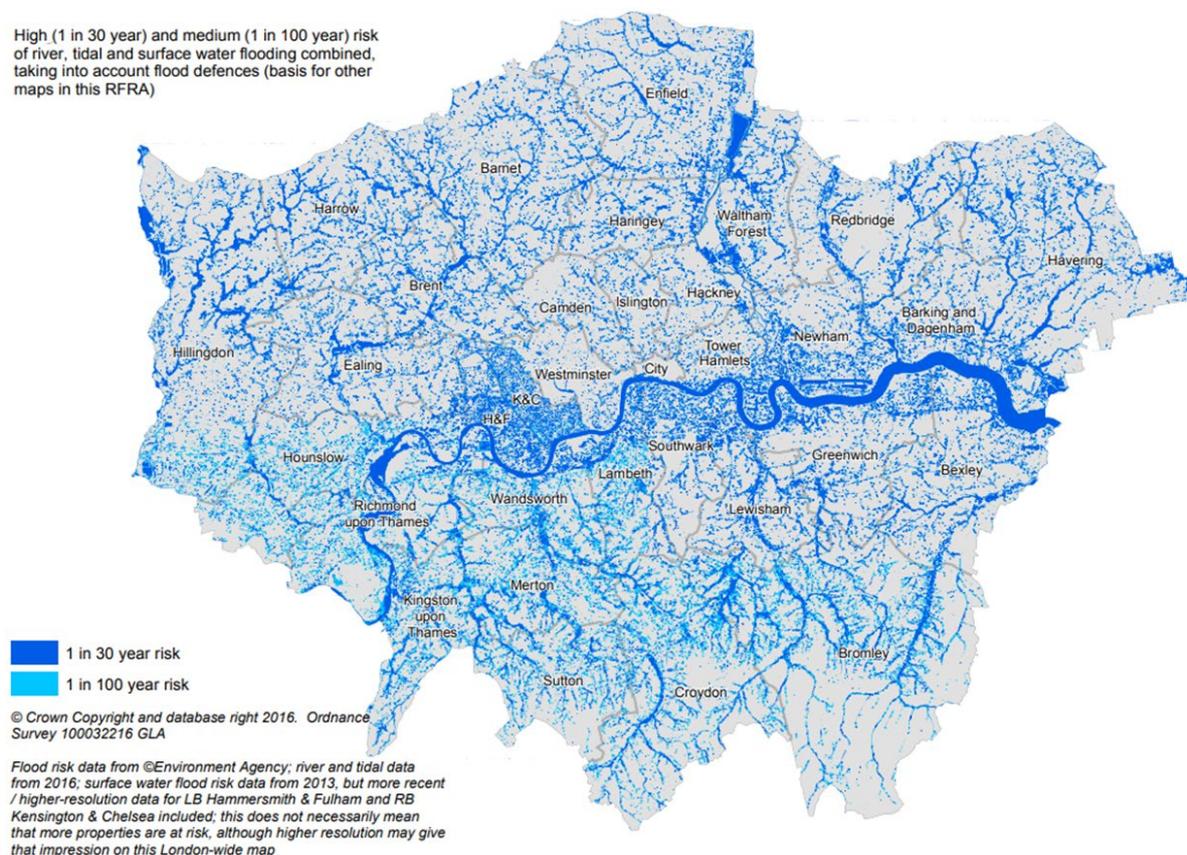
London is already prone to flooding from 5 different sources: tidal, fluvial (from rivers), sewer, surface (from heavy rain) and groundwater. The 2018 London Regional Flood Risk Appraisal found that **6% of London is at high risk for tidal, river or surface water flooding**, where high risk was defined as a 1 in 30-year event, while medium risk, defined as a 1 in 100-year event, affects 11% of the city.¹⁴

Figure 7 shows the parts of the city subject to different levels of risk. Climate change will impact each of these types of flooding, with rising water levels and more frequent heavy rain leading to elevated risk across the city. Recognising the multiple sources of risk is important as each requires different types of intervention; investment in flood defences on the Thames and its tributaries will alleviate the risk of fluvial flooding but will not prevent surface or sewer flooding events, which is expected to rise in frequency as climate change severity increases.

¹⁴ GLA (2018), [London Regional Flood Risk Appraisal](#).

Figure 7 Risk of flooding from multiple sources in Greater London

High (1 in 30 year) and medium (1 in 100 year) risk of river, tidal and surface water flooding combined, taking into account flood defences (basis for other maps in this RFRA)



Source: London Regional Flood Risk Appraisal 2018

At the same time, more frequent dry periods increase our consumption of water and constrain its availability when we need it most, leading to increased chances of drought as seen in the summer of 2022. Thames Water recognise this in their long-term strategies for drainage and waste management and their Water Resource Management Plan. In the short term, green and blue infrastructure will be required to mitigate flooding and urban heat island effects.

There is growing awareness and research backing the social, environmental, and economic benefits of nature in creating liveable cities, with natural capital a valuable asset to the overall economy. While the current planning approach is one of no net environmental loss, this should shift to an environmental net gain principle for development, including housing and infrastructure.

Reaching Net Zero: energy demand and supply

The UK is committed (Climate Change Act 2008) to reducing its greenhouse gas emissions by at least 80% by 2050, relative to 1990 levels. It is currently halfway to meeting its target, thanks to largely phasing out coal use, but the next decade will be a challenging test in decarbonising. Given its scale and its potential for innovation, London will play a critical role in helping the UK achieve its national ambition and requirement.

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Despite London experiencing significant economic growth and a population increase of 25% since 2000, its emissions reduced by 45% in the same timeframe.¹⁵ With 13% of the UK's population, it accounts for only 8% of national carbon emissions and has the lowest per capita emissions of any region in the UK.¹⁶ London has implemented some significant schemes to support its decarbonisation, including through substantial investment in public transport which includes electrification of buses, expansion of cycle infrastructure, and schemes to reduce congestion; investment into green spaces; and introduction of energy-efficient building regulations.¹⁷

To meet the Mayor of London's target for London to be Net Zero by 2030, London's power, heating, cooling, and transport sectors need to move rapidly towards being zero carbon. There needs to be a full-scale shift away from traditional combustion engines towards electric, hybrid or hydrogen vehicles, including in public transport fleets. London will also need more energy efficient housing and building stock – including large scale retrofit of existing buildings alongside higher standards for the energy performance of new development.

A recent study evaluating 100 global cities placed London 6th overall for urban sustainability but with some caveats. Existing transport infrastructure and green space are seen as strengths, but less so *sustainable* transport infrastructure, notably limited access to electric vehicle charging points. London's commitment to renewables is positive, but while the city has implemented several schemes which have reduced emissions over time, it still needs to invest in its energy transition.¹⁸ There is still a long way to go, both for London and for the UK, but with the developments seen in the capital it is clear that if the UK is to achieve Net Zero, then it needs London to achieve Net Zero and will look to the capital as a leading example.

Achieving Net Zero will require diversification of energy sources and widespread electrification of transport and heating, requiring a re-think and redevelopment of existing energy infrastructure. Land will be required for new energy infrastructure, particularly associated with decarbonisation and local energy generation, for instance solar panels, bio-fuels, storage, and more. This requirement could create tension with the need for more green space and natural capital.

Given that electricity capacity problems are already evident in London, with delays in securing connections to the grid threatening the development of homes and other buildings, energy supply pressures will only increase without work to increase the capacity of the grid and to allow for more smaller scale and localised renewable energy generation. Local authorities will need to develop fit-for-purpose commercial and financial models for participating in local energy markets.

¹⁵ GLA (2020), London Energy and Greenhouse Gas Inventory.

¹⁶ BEIS (2020), UK local authority and regional greenhouse gas emissions national statistics: 2005-2020.

¹⁷ All London boroughs have agreed an ambition to achieve an average Energy Performance Certificate level of B for all of the capital's homes by 2030, which will require significant investment and more strategic alignment of housing development with renewable energy generation.

¹⁸ Arcadis (2022), [The Arcadis sustainable cities index](#).

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The emergence of initiatives like 3Ci¹⁹, which is developing a new approach to drive private investment in low and net zero carbon projects and the Mayor's Green Bond, which secured funding for approximately £500m to deliver decarbonisation and climate related projects in London, demonstrate how London is developing innovative approaches to tackle these challenges. But the scale of the response will clearly need to grow rapidly if London is to achieve its sustainable ambitions.

Sub-regional infrastructure pressures & priorities

Different parts of London have varying levels of infrastructure provision and capacity, ranging between specific maintenance and adaptation requirements, different supply constraints, and different economic patterns driving demand. In some places, the pace of development has outstripped the ability to provide essential infrastructure services from access to utilities like energy or digital connectivity to proximity to sufficient public transport. These legacy gaps in infrastructure provision will hold back wider regeneration, which has wider implications when demand for development is increasing.

Infrastructure quality is difficult to measure for any specific service much more across the six infrastructure forms considered in this framework. Distilling analysis from across a range of sources alongside qualitative feedback from Leaders and Mayors as well as strategy officers from across London has made it possible to provide a high-level overview of the pressures and constraints affecting each of London's four Sub-Regional Partnerships (SRPs). The SRPs are partnerships between boroughs within London, political organisations which support sub-regional advocacy and strategy development.

The SRPs each represent large and complex economies, each facing different pressures linked to their own distinct local conditions and operational capacity. Considering each of the SRPs' economic development trajectory, alongside the distinctive infrastructure pressures, begins to suggest where strategic infrastructure could begin to fill gaps and support further ambition (figure 8).

This capacity and art of the possible is particularly important given the role infrastructure has always played in supporting London achieve its economic potential. This is as true now as it has ever been. Looking forward, infrastructure will play a core role in delivering inclusive and sustainable growth across all London boroughs and SRPs by unlocking the opportunities across its major regeneration and innovation developments.

¹⁹ [3ci](#) was co-founded by London Councils alongside Core Cities UK and Connected Places Catapult to find investable solutions for achieving Net Zero.

Figure 8 Infrastructure priorities and pressures across the four Sub-Regional Partnerships



WLA is home to significant logistics hubs, and is moving towards green logistics and innovation. Like Local London and SLP, WLA has orbital connectivity constraints, but more focused work has been done on physical infrastructure to date, for instance through the proposal for West London Orbital. WLA's partnership working is evidenced across current work on the *West London Area Energy Plan* as well as production of the *West London Strategic Infrastructure Delivery Plan*, which provides a comprehensive view of subregional pressures and priorities:

- Electricity grid capacity constraints delaying development
- Notable flood risk in Brent
- Significant air pollution around Heathrow
- Focusing on transport infrastructure to unlock development
- Rolling out low and zero emission networks, hydrogen and alternative fuels to transform and secure energy provision



SLP has historically worked together particularly on public services and health integration, but is looking to build more capacity to unlock economic development opportunities, including those at London Cancer Hub in Sutton and continued development of Croydon town centre. SLP has strong social infrastructure, but a number of physical infrastructure pressures:

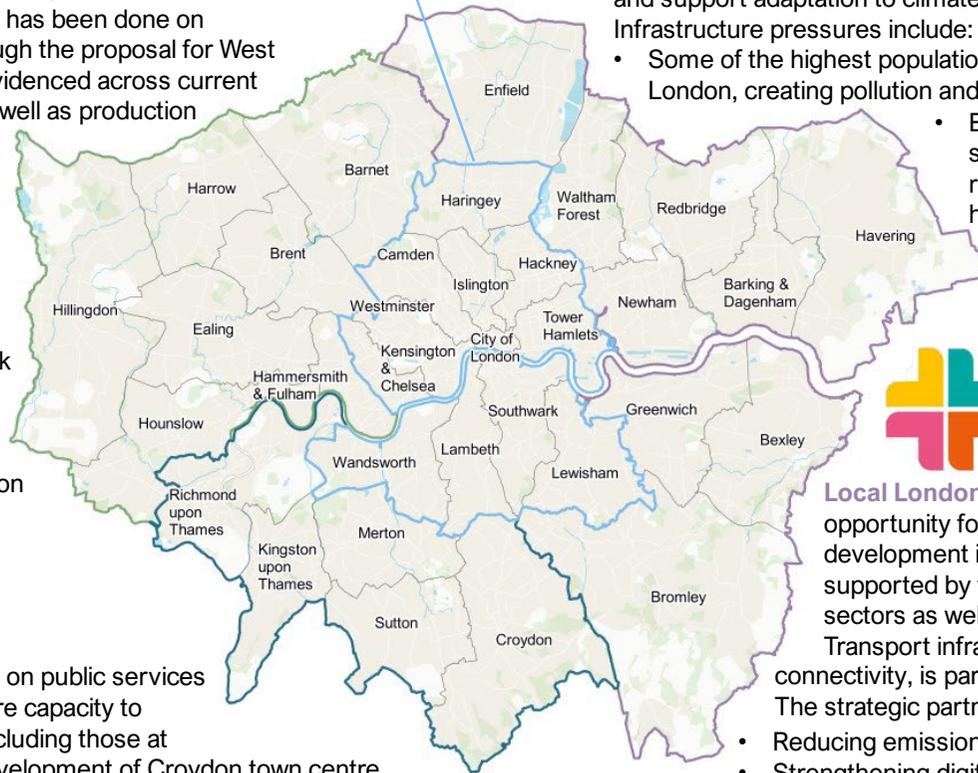
- Spotty broadband coverage
- Flood risk concerns, particularly around Richmond.
- Transport connectivity, particularly across the sub-region and with other outer boroughs
- Risks to electricity supply consistency, with supply largely via underground cables just below street level, creating risk of maintenance disruption

Central London Forward

CLF is made up of 12 boroughs, including the City of London and Central Activities Zone. It was particularly affected by the economic impact of Covid -19 lockdowns. Going forward, its infrastructure priorities include projects that can drive economic growth, enable housing delivery, and support adaptation to climate change and reaching Net Zero.

Infrastructure pressures include:

- Some of the highest population density and congestion levels in London, creating pollution and air quality concerns
- Exposure to flood risk and limited surface water drainage, with particular risks of flash flooding in periods of heavy rain
- Pockets of poor digital connectivity, despite high concentration of businesses
- An acute housing shortage



Local London benefits from some of the greatest opportunity for housing and commercial development in all of London, which must be supported by the attraction of new industries and sectors as well as new and improved infrastructure. Transport infrastructure, supporting orbital connectivity, is particularly seen as vital to future growth. The strategic partnership is also focused on:

- Reducing emissions and town centre congestion
- Strengthening digital connectivity
- Exploring opportunities for waterborne freight
- Leading exploration of hydrogen's role in the energy transition

Local London is particularly faced with infrastructure pressures in the form of flood risk, water supply constraints, and electricity grid constraints.

Sources: Central London Forward (2021). [Central London's Infrastructure Priorities: Sustainable, connected and productive.](#)

West London Alliance (2022). [West London Strategic Infrastructure Delivery Plan 2021-40.](#)

3 Infrastructure’s role in inclusive and sustainable growth

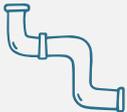
London is in a better position than many other cities in the UK to kickstart economic growth. The capital has the scale, the experience, and the magnetism to adapt to adverse circumstances and to pivot towards future growth sectors; in the process supporting new forms of more inclusive growth. With the right approach, the city can be a beacon of transformational investment, driving capital and resources towards supporting residents, businesses, and the national economy.

This starts from the ground up: physical development is key to supporting economic opportunity. It allows research and business to thrive in fit-for-purpose spaces, unlocks world-class placemaking which maintains London’s reputation globally and ensures residents are well-served in their local neighbourhoods. To empower the major development and regeneration projects which are vital to London’s ongoing success, the role of physical infrastructure must be redefined and expanded in terms of its relationship to wider economic opportunity.

A legacy of transformative infrastructure

London has been able to evolve throughout its history by having the right enabling infrastructure, with world-leading provision enabling growth to date, and the need for continued investment and innovation to both keep pace with demand and to maintain London’s global position and leadership. Its legacy of delivery also speaks to the capital’s ability to deliver transformative schemes, a track record that will be vital to identifying and delivering infrastructure of the future, particularly with innovative new approaches to address the climate crisis, support inclusive economic opportunity, and establish national and global best practice. This record also shows that investing in the capital’s infrastructure also promotes economic growth that delivers strong returns to the Exchequer that have been used to boost public spending elsewhere in the country.

Governing authorities and industry worked together on regulation and planning to co-ordinate significant engineering enhancements, notably London’s first sewer network which helped wipe out cholera in the capital and the London Underground. In 1885 the London Electricity Supply Corporation was established to oversee the expansion of electricity supply, and in 1903 the Metropolitan Water Board co-ordinated responses to combat the growing demand for water. This type of co-ordination meant the city had the structure and resources to respond to the pressures of a rapidly growing population, delivering a range of major developments from the Victorian-era ‘super sewer’ to the world’s first underground railway.

			
Development of London’s sewer system by Bazalgette	World’s first underground rail, now a successful network	New governance to coordinate electricity & water	Great Western Railway connecting London & Bristol

The London Docklands Development Corporation, established by Michael Heseltine, was an early and leading delivery model that led to significant regeneration across London, including

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the creation of Canary Wharf, Surrey Quays and London City Airport alongside significant transport infrastructure in the Docklands Light Railway and the Jubilee extension.

London's track record of delivering transformational infrastructure has been cemented in the period since the Greater London Authority and Transport for London were established in 2000. Today, infrastructure planning in London is still used to manage the growing population and its associated pressures, but it is also intrinsically linked with regeneration. The 2012 Olympic Games is demonstrative of this, where the infrastructure required for the Games coincided with several significant regeneration schemes across East London boroughs delivering new housing and public realm.

The opening of the Elizabeth Line, the extension of the Northern Line, and the ongoing delivery of HS2²⁰, have all coincided with major regeneration and housing schemes. The developments seen in Woolwich, Battersea, and Old Oak Common are exemplars of what can be achieved through this relationship.



TfL and National Rail are both significant landowners in London. TfL has a property portfolio of 5,500 acres valued at £1.7bn,²¹ not just comprised of operational holdings but also including the land around stations and brownfield land which presents development opportunities. TfL's commercial property company, TTL Properties, aims in the long term to develop land to generate a profit that can support London's public transport systems. But TfL's funding settlement is severely constrained, as it only goes until March 2024, meanwhile other mayoral combined authorities now have City Region Sustainable Transport Settlements (CRSTS) until March 2032. This creates uncertainty and effectively means that the London-style funding model is now more advanced in places outside of London than it is in the capital itself, just as the Mayor of London is looking for TfL to generate additional revenue.²²

National Rail likewise operates an extensive network throughout London, including 14 terminal stations which are major hubs for regional, national, and international travel. Most of these were developed in the mid-19th century around the edge of central London, and most have since been upgraded and modernised to provide greater capacity and connections to the network. In addition to bringing together national and international networks, these stations have significant impacts on their local areas, stimulating wider regeneration as well as business opportunities by bringing in broad labour markets and building global connectivity and reputation.

²⁰ As of March 2023, HS2 delivery has been significantly delayed, and while it still creates important regenerative opportunities in London, Sir John Armitt (chair of the National Infrastructure Commission) suggests the delays and changes in delivery programme might have spillover effects for driving investment into the UK. Source: [The Guardian](#) (March 2023).

²¹ Hollewe, Julie (2022). "[How Transport for London plans to build 20,000 new homes](#)". The Guardian.

²² Huseyin, Deniz (2022). "[TfL to get £1.2bn from Government in long-term settlement](#)".

Policy environment for infrastructure funding & delivery

The National Industrial Strategy (June 2018) emphasised infrastructure as one of the five foundations of productivity, fundamental to transforming the UK economy. More recently, the Levelling Up White Paper²³ positioned physical capital as one of the six capitals key to supporting places' economic potential, with transport infrastructure and digital connectivity forming the basis for two of the 12 levelling up missions. The Levelling Up Fund earmarked £4.8bn for infrastructure investment in towns across the UK; 14 projects in London have been funded a combined total of £216m through the Levelling Up Fund.²⁴

At the same time, the Levelling Up agenda has shifted recent Governments' focus towards boosting economic performance outside of London and the South East, making new infrastructure projects in the capital a lower priority for national intervention. Reforms of the HMT Green Book now require business cases to demonstrate how projects will directly contribute to the delivery of national strategic objectives. This may mean that projects with better strategic fit, particularly to policy aims around Levelling Up, can be prioritised over those which can deliver greater return on investment. The net result is that less public funding could be available for London-based initiatives, despite the interpersonal and interborough inequalities that affect the lives of the region's residents and the potential of its economy (figure 9).

The March 2023 Budget advanced decentralisation via ambitious new Trailblazer devolution deals with Greater Manchester and West Midlands Combined Authorities, but included relatively few references to London or its role in national productivity and economic growth. There was fairly little in the Budget on strategic infrastructure, which will be covered instead in the forthcoming National Infrastructure Assessment.

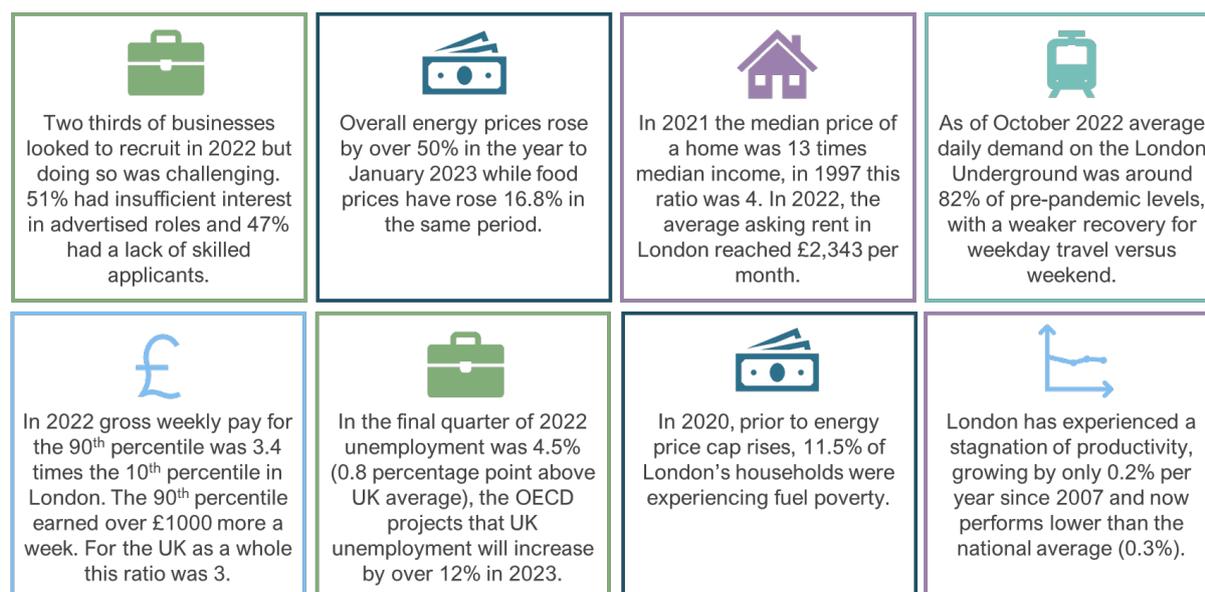
Limitations to Transport for London's funding settlement, particularly compared to CRSTS elsewhere, demonstrates how changes in the national policy environment create real impacts for investment and capacity within London. Mixed-use regeneration projects that would previously have been taken forward have instead stalled, with the need to rapidly find and deliver alternative commercial arrangements with potential funding partners.

The combination of constraints means there is more pressure than ever on London to drive its own development agenda. The challenge is not an easy one, mitigating immediate economic pressures, looking towards long-term economic drivers, and reducing reliance on carbon intensive fuel sources all at once. Relatively few places have the scale and capacity to respond and adapt to these economic and political circumstances, but London has the commercial value and track record to increase its self-sufficiency and deliver inclusive, sustainable, and future-proofed growth for all its residents.

²³ HMG (2022). [Levelling Up the United Kingdom](#).

²⁴ HMG (2023). [Levelling Up Round 2: thematic and geographic analysis](#).

Figure 9 Economic and environment challenges facing London



Sources: London Business 1000 Survey (2022). ONS Consumer Price Inflation (January 2022). ONS Housing Affordability. TfL Annual Report 2022. Metro Dynamics analysis of Annual Survey of Hours and Earnings. GLA Unemployment Rate, Region & OECD Unemployment Rate Forecast. ONS Fuel Poverty. Rightmove Hub Trends Tracker Q3 2022. Centre for Cities (2023), *The role of London in the UK's productivity puzzle*

A vast network of roles and responsibilities

Delivering aspirational and future-proofed infrastructure projects is no small task. The operating environment for infrastructure in London is complex, with responsibilities split across local, regional and national providers, and funding models that are highly reliant on public subsidy and central control.

Physical infrastructure is owned and managed by a wide range of organisations at local and national levels, including public and private sector. This includes:

- **National policy and regulatory drivers**, e.g., the Department for Transport, Highways England, Civil Aviation Authority, Ofgem, Ofwat, Ofcom, OfGem, Environmental Agency, and others.
- **Regional and national delivery organisations**, e.g., Transport for London, Network Rail, National Grid, UK Power Networks (UKPN), Scottish and Southern Electricity Networks (SSEN), Cadent Gas, British Gas, Thames Water, Environment Agency, and sub-regional waste management authorities (North London Waste Authority, West London Waste Authority, Western Riverside Waste, East London Waste Authority, South London Waste Partnership, and individual boroughs).
- **Private investors and developers**, typically providing site-specific infrastructure as required for individual developments, as well as contributing to area-wide infrastructure through Community Infrastructure Levy and Section 106.

The complex environment for infrastructure provision causes fragmentation and siloes exacerbated by frequent changes in legislation, regulation, and planning. National policy and planning are not joined up, while regulators operate independently of one another with different planning cycles and time frames. Infrastructure is also part of a complex political

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ecosystem in which there can be immense obstacles to securing cross-party buy-in for large-scale projects which span years or decades. This also leads to complications in securing funding or increased costs due to delays.

Confusion in the system can cause blockages or stall delivery due to insufficient coordination between utility suppliers and those delivering. The Greater London Authority (GLA) plays an important and growing role in the coordination of these various regulators and providers:

- The GLA Infrastructure Coordination Service (ICS) leads and coordinates work with partners who provide infrastructure in London, in alignment with the Mayor of London's priorities and developing new policies in response to issues identified. The ICS has developed and hosts the Infrastructure Mapping Application (IMA)²⁵, an interactive web-based tool displaying current and planned infrastructure, as well as key contextual information, accessible to local authorities and infrastructure and transport providers.
- The GLA planning team oversees the London Plan, which sets out an overarching economic, environmental, transport and social framework for development, as well as collating opportunity areas and growth corridors and managing GLA-level community infrastructure levy.
- Individual boroughs also act as local planning authorities, managing borough-specific development as well as borough-level community infrastructure levy.

Even with the GLA supporting infrastructure planning and coordination within London, there has historically been limited bottom-up strategy and insufficient spatial strategy involved in the provision of utilities. Thames Water's funding settlement, for instance, is a London-wide budget with relatively little proactive prioritisation, and a more ad hoc approach to delivering sub-regional interventions. At the same time, not all boroughs are signed up to or making use of tools like the IMA, nor do many have capacity to stretch their planning teams to link up infrastructure provision with its role in economic development.

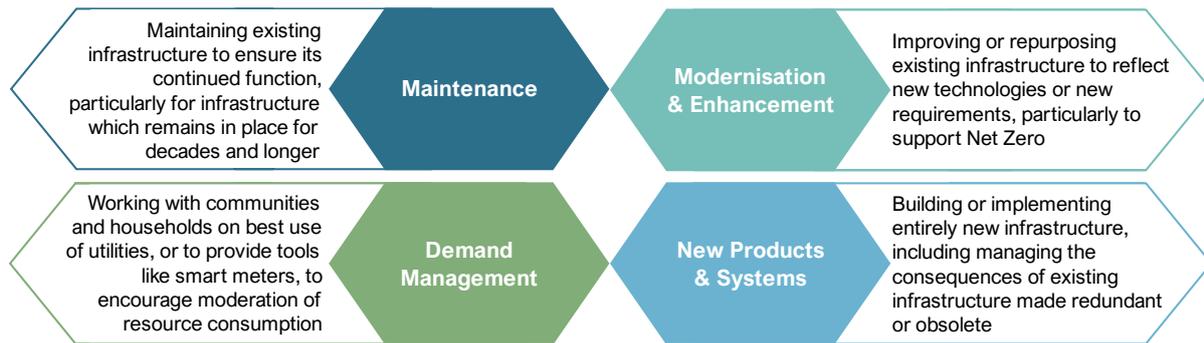
Historically, lack of bottom-up direction has been in part due to the fact that infrastructure does not respect borough boundaries; infrastructure systems are vast and interconnected. Interconnected approaches to planning are therefore vital to resilience and optimisation of infrastructure systems, and there are economies of scale to be gained in preparation and delivery of sub-regional assessments. The GLA is piloting a number of sub-regional infrastructure assessments across water, energy and digital, building a robust methodology and framework for collaboration with boroughs before replicating and maintaining the approach across London.

Types of infrastructure interventions

Not only must the various actors provide a range of integrated solutions, but also consider a range of types of projects related to the provision and maintenance of infrastructure (figure 10). Delivering against the different types of interventions required in a holistic system is an ongoing challenge for providers, but ensuring the city can continue to grow responsibly will require a combination of all of these.

²⁵ Mayor of London. [Infrastructure Mapping Application](#).

Figure 10 Types of interventions required to provide and maintain infrastructure



In addition to a multifaceted delivery environment, each type of infrastructure also depends upon other infrastructure provision, and these interconnections play a critical role in the provision of effective and strategic infrastructure. The management of these systems, and their interconnections, can make it difficult for infrastructure to respond to change; harmonisation could deliver significant dividends for cost and delivery efficiencies as well as quality. Work is being done in support of better information and collaboration, for instance the City of London working with the GLA and National Underground Assets Register (NUAR) to look for better ways of mapping underground assets.

There are opportunities to improve the functioning of infrastructure provision, with significant rewards for increased efficiency and collaboration, and a clear opportunity for the public sector to leverage its control to drive improvements. The scale of the requirement should not be underestimated, nor should London's ability to meet the challenge.

Infrastructure as driver of sustainable and inclusive economic growth

Infrastructure is what enables places to grow and evolve in a meaningful and efficient way. It connects people across large metropolitan areas to education, healthcare, places of employment and leisure, while providing economic centres with the essential services of water, waste, and electricity. Effective infrastructure provision makes further responsible growth possible; shortcomings in infrastructure mean not only that current residents struggle to access essential services, but also that future growth cannot be sustained.

Done right, physical infrastructure not only meets existing neighbourhoods' and residents' needs, but also lays the groundwork for future development and opportunity:

- **Transport** connectivity means that people can get between places more effectively, opening up options for residents in places from which work and leisure are still accessible. Major transit hubs across London – from Heathrow to King's Cross, Stratford and Waterloo – greet national and international visitors and businesspeople, enhancing London's and the UK's reputation as a place to visit, live and do business.
- **Digital** connectivity means not only that people can work flexibly and from home, but also that businesses can process immense amounts of information and innovate, with the concurrent increases in **energy** demand being met through sustainable and increasingly local energy sources.
- Effective management of **water** resources means that population growth can be sustained, with smart technology supporting responsible consumption patterns to ensure

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that people everywhere can access this essential resource; meanwhile effective [mitigation of flood risk](#) protects homes and physical assets for generations to come.

- [Waste management](#) not only serves existing communities, but advances in technology means that waste can be processed more efficiently, making circular processing possible to reduce what we even consider to be waste, including through utilising its potential as a heat source.

Driving inclusive economic growth and opportunity

Improving capacity for delivering aspirational infrastructure projects could unlock the investment needed to kickstart London's economic growth, with real benefits for its residents and for the national economy. Limitations to London's growth and productivity, on the other hand, have accounted for 42% of the national productivity slowdown between 2007-2019.²⁶ Economic growth going forward must not only be sustainable and long-term, but also inclusive to address wealth and spatial inequalities.

The richest 10% of households in London own more than 60% of London's total wealth, and spatial divides across boroughs mean that many struggling with high rents, lack of economic opportunity, poor connectivity, and high property prices and costs of living.²⁷ Not only can infrastructure lay the groundwork for development and economic growth, but it can also help to ensure opportunities are available to all London's residents and communities by enhancing connectivity, protecting local environments, and decreasing household costs. It can also protect people's health, by improving air quality, by improving leisure time and sense of wellbeing, and by ensuring health and social infrastructure are well-served.

London is the ideal place to develop better ways of working: it has an iconic history of delivering world-leading infrastructure projects, successes that have built its reputation and made its growth possible; it has the necessary commercial value and scale to drive further investment; and there is willingness across local and regional organisations to bring renewed vitality to managing the system and finding new opportunities.

Relationship to housing

Effective enabling infrastructure is also key to housing quality and delivery. London's housing stock is currently constrained, with insufficient affordable housing, overcrowded households, and energy inefficient and outdated housing stock. Recent analysis shows that these housing constraints in London present a challenge to national labour mobility, holding back UK productivity growth and preventing highly skilled people from reaping economic benefits from living in London.²⁸ Opening up transport connections makes housing delivery more viable in places with available land; digital, energy, water and waste management infrastructure are essential to the remediation of brownfield land.

Infrastructure is a key determinant of the quality of a home, ensuring that residents have access to basic and essential services. This is particularly necessary as hybrid working means that many residents are spending more time at home than ever. And retrofit of

²⁶ Rodrigues, Guilherme; Stuart Bridgett (March 2023). [Capital Losses: The role of London in the UK's productivity puzzle](#). Centre for Cities.

²⁷ GLA (2020), Wealth Inequality.

²⁸ Stansbury, Anna; Dan Turner; and Ed Balls (March 2023). [Tackling the UK's regional economic inequality: Binding constraints and avenues for policy intervention](#). Mossavar-Rahmani Center for Business and Government, Harvard Kennedy School.

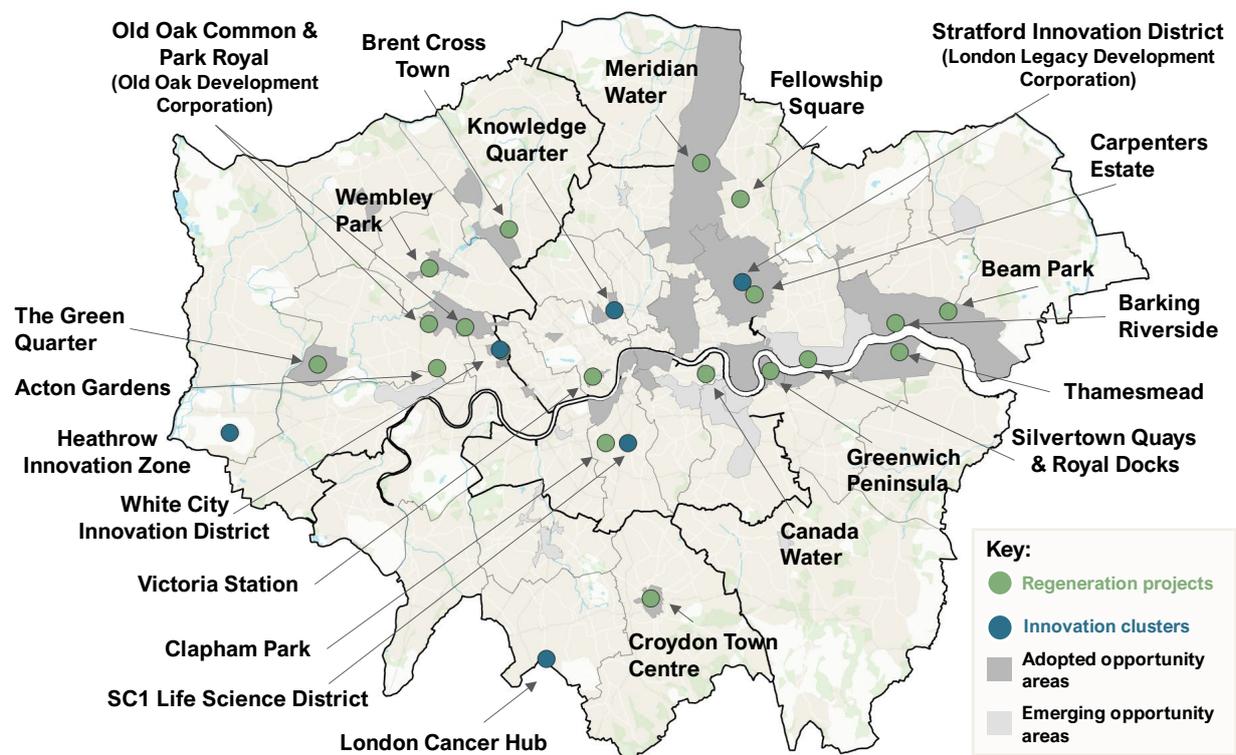
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existing housing stock to make it more energy efficient is vital to reducing energy spending and emissions, as well as protecting individuals' health and wellbeing. Effective infrastructure delivery not only opens up development opportunities, but also mitigates knock-on effects from connectivity and densification, ensuring that social infrastructure provision is sufficient to keep pace with growing local demand.

Relationship to wider regeneration and development

Infrastructure has been essential in unlocking development and supporting the evolution of the city over several decades. The mayor's London Plan²⁹ identifies a series of Opportunity Areas as key locations for new homes, jobs, and infrastructure of all types. These Opportunity Areas can be seen to be linked to major regeneration and innovation clusters across London, highlighted in figure 11.

Figure 11 Major regeneration & innovation projects in London (Winter 2023)



Source: Metro Dynamics analysis (March 2023); GLA Opportunity Areas (2022)

Many of these projects and Opportunity Areas, are linked to existing or potential public transport improvements which are a determinant of strategic infrastructure projects. Many of the sites highlighted have been made viable by major transport schemes: Old Oak Common and HS2; Acton Gardens and the Elizabeth Line; Nine Elms and the Northern Line extension; and Brent Cross Town and a new Thameslink station. Equally important is London's development of centres of innovation or Innovation Districts, leading to wider regeneration as seen in areas like White City in Hammersmith, the Knowledge Quarter at Euston and the Queen Elizabeth Olympic Park in Stratford.

²⁹ The London Plan is the spatial development strategy for Greater London, setting out the framework for how London will develop over the next 20-25 years. Source: Mayor of London (2021). [The London Plan](#).

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These major development projects and opportunities have the potential to drive significant economic activity in places, and to strengthen neighbourhoods and communities across greater London. This further demonstrates the catalytic impact infrastructure plays in creating and unlocking opportunity, investment, regeneration and growth across the city.

Vision for the future of infrastructure delivery

Going forward, a more strategic approach to spatial planning for infrastructure is needed to ensure opportunities are balanced across the capital: reflecting and promoting a polycentric approach which shares wealth and opportunity across all of London's communities. A longer-term approach must consider different types of infrastructure projects within a diverse portfolio to attract investment and deliver the benefits necessary to realise London's economic framework and vision.

London's infrastructure framework is designed to identify and advance projects and programmes that support London's economic framework, delivering London's inclusive and sustainable future. It aims to unlock short-term opportunities to drive regeneration, whilst also laying the groundwork for a more long-term approach which builds capacity to deliver infrastructure that supports inclusive economic growth across the capital. All infrastructure included must embed sustainability as a core aim, contributing to London's resilience to climate change, clearly contributing in the medium to long term to London's decarbonisation.

London will need to play to its strengths to deliver on its ambition. The region is highly capable of driving growth, within and beyond its boundaries, and can address some of its longer standing issues, but to do so it must be able to consider different approaches and models. The city must not be reliant on one-off and short-term funding allocations or else it will be at risk of stalling.

4 Strategic infrastructure framework

At any given time, a significant number of infrastructure projects are being delivered and developed across London. They are managed by a number of different providers – from national and regional regulated providers to the infrastructure developed as part of regeneration initiatives by boroughs and by private sector developers.

The purpose of the framework is not to impede this day-to-day activity, but to identify opportunities for planning and delivery to be done more efficiently, to support ambition across infrastructure projects and programmes, and to enable more effective integration of communications to support strategic projects in accessing funding and accelerating delivery.

As London looks to the future and continues to address its short- and long-term infrastructure pressures, effective co-ordination and communication is more important than ever. This framework brings four main benefits for London:

- Collating and mapping, for the first time in one place, the most significant infrastructure opportunities for London and its sub regions, demonstrating the spatial distribution and scale across different infrastructure projects.
- A new and shared methodology to co-ordinate the collation of strategic infrastructure projects across London going forward.
- A typology of strategic infrastructure categories which uses project characteristics – like scale, impact and relationship to regeneration opportunities – to differentiate between infrastructure opportunities.
- A structure to act as the basis for dialogue with investors and Government about significant growth and investment opportunities reflected in a framework that has the backing of the London Leadership system.

Purpose and priorities

The strategic infrastructure framework provides a conceptual framework for understanding infrastructure projects and their relationship to a set of strategic priorities (figure 12). The strategic priorities were confirmed through extensive engagement with key stakeholders – including borough Leaders and Mayors, and officers in Sub-Regional Partnerships and boroughs – and have been informed by discussion with the GLA and TfL. The framework reflects primarily the views of London’s boroughs, but seeks to be broadly aligned with GLA and TfL strategies, and where differences arise these have been noted.

The underlying objective of the framework is to support London’s economic framework, and to highlight projects with positive social, environmental and economic impact that can support inclusive growth, promote Levelling Up, and help reach Net Zero. The priorities together support the aims of London’s economic framework whilst also addressing development- and environment-specific requirements.

The priorities are purposefully broad, allowing for flexibility and judgment when assessing the relevance of projects to the pan-London approach. While housing and social infrastructure are not included in this framework at present, the priorities also emphasise the relationship between enabling infrastructure and the delivery of wider development requirements in line with London-wide needs.

Figure 12 Strategic priorities of the London infrastructure framework

 <p>Reaching Net Zero Embedding sustainability, decarbonisation, and climate resilience</p>	 <p>London-wide Impact Potential for multi-borough social and economic impact, often as well as multi-borough scale</p>
 <p>Future-facing Balancing need to keep pace with demands and requirements, with broader structural changes needed</p>	 <p>Considering Geography Enhancing the relationship between infrastructure and strategic spatial planning across greater London</p>
 <p>Housing & Development Unlocking employment space, social infrastructure, or housing; enabling use of planning consents</p>	 <p>Deliverable & Investable Sufficiently developed as to indicate deliverability, even if funding needs are outstanding</p>

The strategic priorities not only support inclusive growth, but they also reflect the principles core to impact investment: intentionality, additionality, and measurability.³⁰ In reviewing projects' relevance to the infrastructure framework, they were assessed not only for their strategic fit, but also for the ambition and aspiration that underpins them.

A wide range of projects across various types of infrastructure are relevant to delivering on the strategic priorities set out above. In order to understand projects' and programmes' relationship to the economic framework, four strategic categories further conveys their contribution (figure 13).

The categorisation process set out here can be used on an ongoing basis to capture and understand the strategic role and scale of different planned or emerging infrastructure projects and programmes. This is essential to encapsulating a London-wide view of priority interventions and being able to communicate effectively about these to different audiences, including Government and investors.

While projects and plans change over time, the strategic priorities and categories of relevant projects represent a structure and way of thinking about London's longer-term future while also reflecting on the role of infrastructure in unlocking development in the near term. Critically, while the remainder of this section goes on to set out specific projects and programmes relevant to the framework, this is only a point-in-time reflection and, in reality, there both *are* and *will be* more projects delivering on the vision of London's inclusive and sustainable future.

³⁰ Impact Investing Institute & Metro Dynamics (2021). *Building Strong Places: A new, impactful role for financial institutions*. Page 15. Available at: <https://www.impactinvest.org.uk/wp-content/uploads/2021/11/Building-Strong-Places-a-new-impactful-role-for-financial-institutions.pdf>

Figure 13 Strategic categories of infrastructure projects and programmes

 <p>Pan-London Exemplars</p>	<p>Projects with London-wide significance, typically with both significant geographic scale and significant potential economic and social impact; performing well against multiple strategic criteria.</p>
 <p>Sub-regional Exemplars</p>	<p>Projects with noteworthy strategic impact and scale, but typically not so extensive as to extend over more than 5 boroughs.</p>
 <p>Growth Catalysts</p>	<p>Projects with typically smaller scale, but significant potential to unlock more immediate growth opportunities through planned housing, employment space, or social infrastructure; typically 1-3 borough footprint.</p>
 <p>Strategic Pilots</p>	<p>Relatively small-scale projects which are pioneering new approaches or employing new technologies to deliver infrastructure and promote sustainability.</p>

Project review methodology

In order to assess the existence of infrastructure projects and programmes linked to the framework priorities, an extensive call for projects was undertaken in Autumn 2022. The call for projects was released to all London boroughs, facilitated by the sub-regional partnerships, as well as taking input from infrastructure planning document review, the GLA, and some utility providers. Levels of detail varied across the collated projects and programmes, reflective of varying levels of development, of commercial sensitivities, and of organisational remit.

A longlist of 180 development projects was reviewed, with an initial sift to consider projects relevant to the infrastructure types considered in the framework (transport, energy, water and wastewater, flood risk management, waste management, and digital) and to identify projects with potential to support wider inclusive and sustainable economic growth. From this initial review, 67 projects were identified as being relevant to the infrastructure framework at present.

Of these 67 relevant project and programmes, not all perform against all strategic criteria, but all contribute meaningfully to short and long-term economic objectives by performing across a mix of priorities. Analysis of these shortlisted projects according to project-type and performance across the range of strategic priorities enabled their categorisation into the four groups set out in figure 13. Physical scale was a significant factor in considering projects' fit, as well as the longevity of projects' impacts.

While projects have been reviewed and consolidated, this has not comprised a formal prioritisation process. The project review conducted in assembling this framework does not establish a formal pipeline of projects for investment, nor has it evaluated projects' deliverability or financial viability. This is instead a point-in-time assessment to identify current strategic projects and set out a framework for understanding key projects going forward. Further detail on each category and currently relevant projects is set out on the following pages, and additional detail on included projects can be found in Annex A.



Pan-London Exemplar projects

Pan-London Exemplar projects typically perform against most of the strategic criteria and particularly demonstrate significant physical scale and socioeconomic impact. They are strategically significant, pan-London projects which look to address long-term issues faced by the city, whether through transport connectivity, protecting water supply and mitigating flood risk, or providing more expansive energy power. 13 of the 67 shortlisted projects fall within this category (figure 14).

Many of these are major transport projects, spanning several SRPs and boroughs, providing extensive connectivity to several projects and aim to deliver immense economic benefit and generate wider regeneration – HS2 already is a good example of this. The recent completion of the Elizabeth Line illustrates what is possible from these long-term projects, but also the time and concentrated effort required to deliver them.

Projects in this category are at varying stages of development. While London Power Tunnels is three years into delivery, others – for instance Crossrail 2 and Thames River Services Expansion and West London Orbital – are not currently being delivered.

This category also includes projects which look to respond to some of London’s long-term infrastructure pressures. London Power Tunnels provides greater access to a reliable electricity supply across several SRPs; the Thames Estuary 2100 programme builds greater resilience to the threat of flooding; the Thames River Services Expansion aims to reduce congestion by using London’s waterways more effectively; and the Connected London work programme looks improve digital connectivity across London, of which a major part is providing access to full fibre Wi-Fi across the entire London Underground Network. TfL’s four lines modernisation programme has been included in Growth Catalysts, but can be considered along similar lines, where maintaining existing infrastructure takes on enhanced strategic significance given role in keeping London’s infrastructure effective.

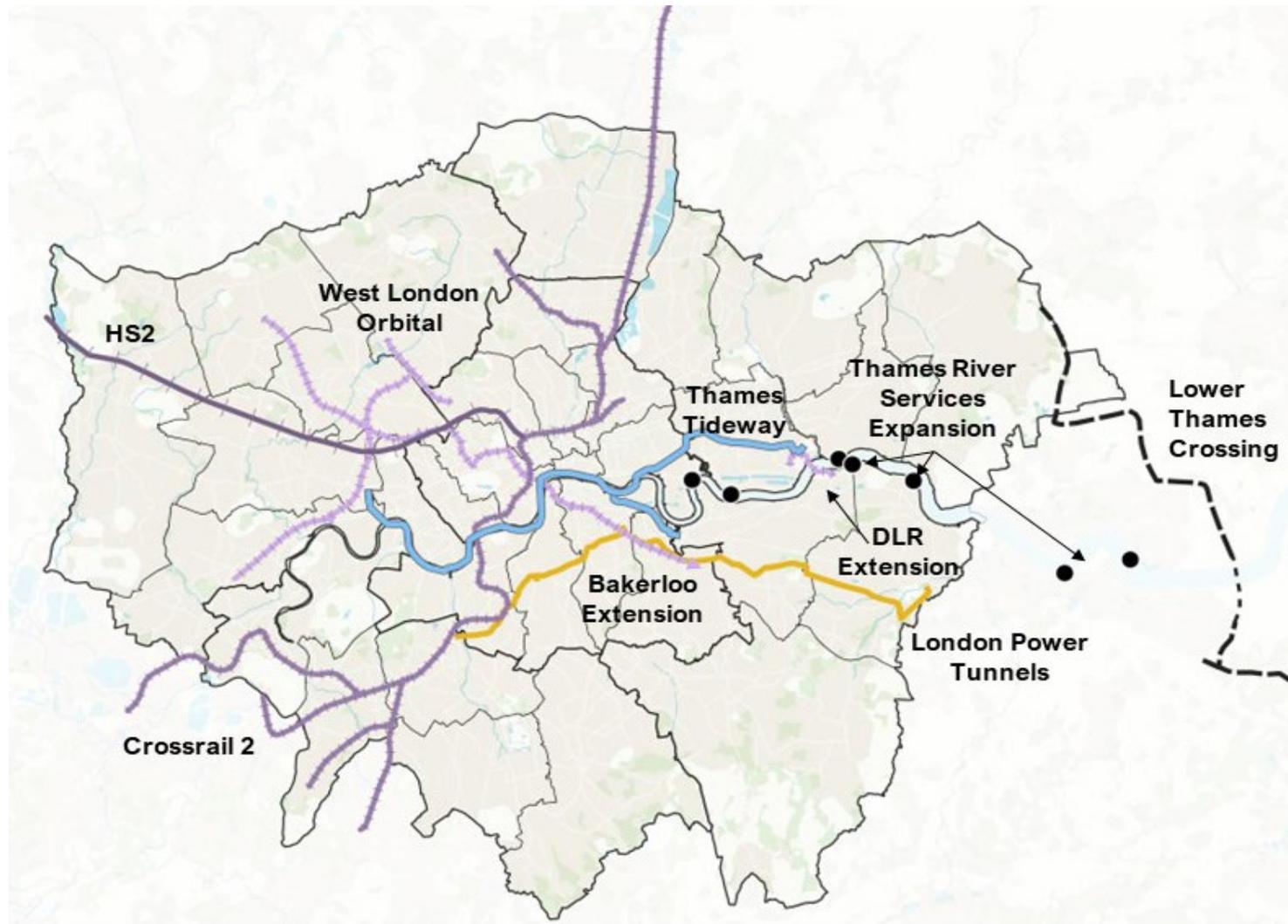
West London Orbital: A proposed new rail link making use of existing, underused lines in northwest and west London, which would become part of the London Overground network. The West London Orbital rail service would run from Hounslow towards Hendon and West Hampstead in the north and provide 10 new unique interchanges.

Connected London is currently delivering 2,000km of full fibre connectivity across the London underground, bringing city-wide connectivity improvement and readying London for 5G.

Thames Water’s **rollout of Smart Meters** across London households will help save water, detect leaks, and reduce carbon emissions.

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Figure 14 Pan-London Exemplar projects



Projects too widespread and/or geographically non-specific to map:

-  **Connected London**
-  **Thames Estuary 2100 programme**
-  **TfL Bus Fleet upgrades & decarbonisation**
-  **Thames Water Smart Meter programme**

Key:

-  Rail & Public Transport
-  Roads, Bridges, Cycleways
-  Energy
-  Water & Wastewater
-  Digital
-  Multiple



Sub-Regional Exemplar projects

Sub-Regional Exemplars include projects which perform against multiple strategic criteria but have a smaller physical footprint than the pan-London projects; they have the potential to create social and economic benefit across several boroughs. Note that sub-regional here does not necessarily mean projects that exist within or impact only one Sub-Regional Partnership. They are generally projects which seek to resolve local, and sub-regional pressures. 18 of the 67 shortlisted projects fall within this category (figure 15).

The projects in this category once again vary in type of infrastructure and stage of delivery. Many of these projects are strong examples of infrastructure delivery at a more local or regional scale, demonstrating what is being done to tackle specific challenges or generate wider growth opportunities.

Some projects relate to those highlighted in other categories and to wider regeneration opportunities. Euston Terminus has been made possible by HS2 investment (captured in pan-London Exemplars) and is also a driving force behind further development of KQ London (highlighted in figure 11). Enabling works at Meridian Water together with the Meridian Line (in Growth Catalysts) present significant investment, making wider area regeneration possible (also highlighted in figure 11).

A large proportion of these projects, as is common with infrastructure in London, are focused on transport connectivity, for instance new railway lines to Heathrow, the Bakerloo Extension and several cycling and walking projects³¹. This category also includes new integrated infrastructure plans being led within several of the Sub-Regional Partnerships: the West London Area Energy Plan, Digital West Programme and Local London digital area plan.

Increasing capacity at **Euston Terminus** would allow for the connection of HS2, Network Rail, London Underground, and the proposed Crossrail 2. Eleven new dedicated platforms, a new concourse and improvements to Underground stations will facilitate not only the efficient operations of HS2, but free up capacity on local and regional services.

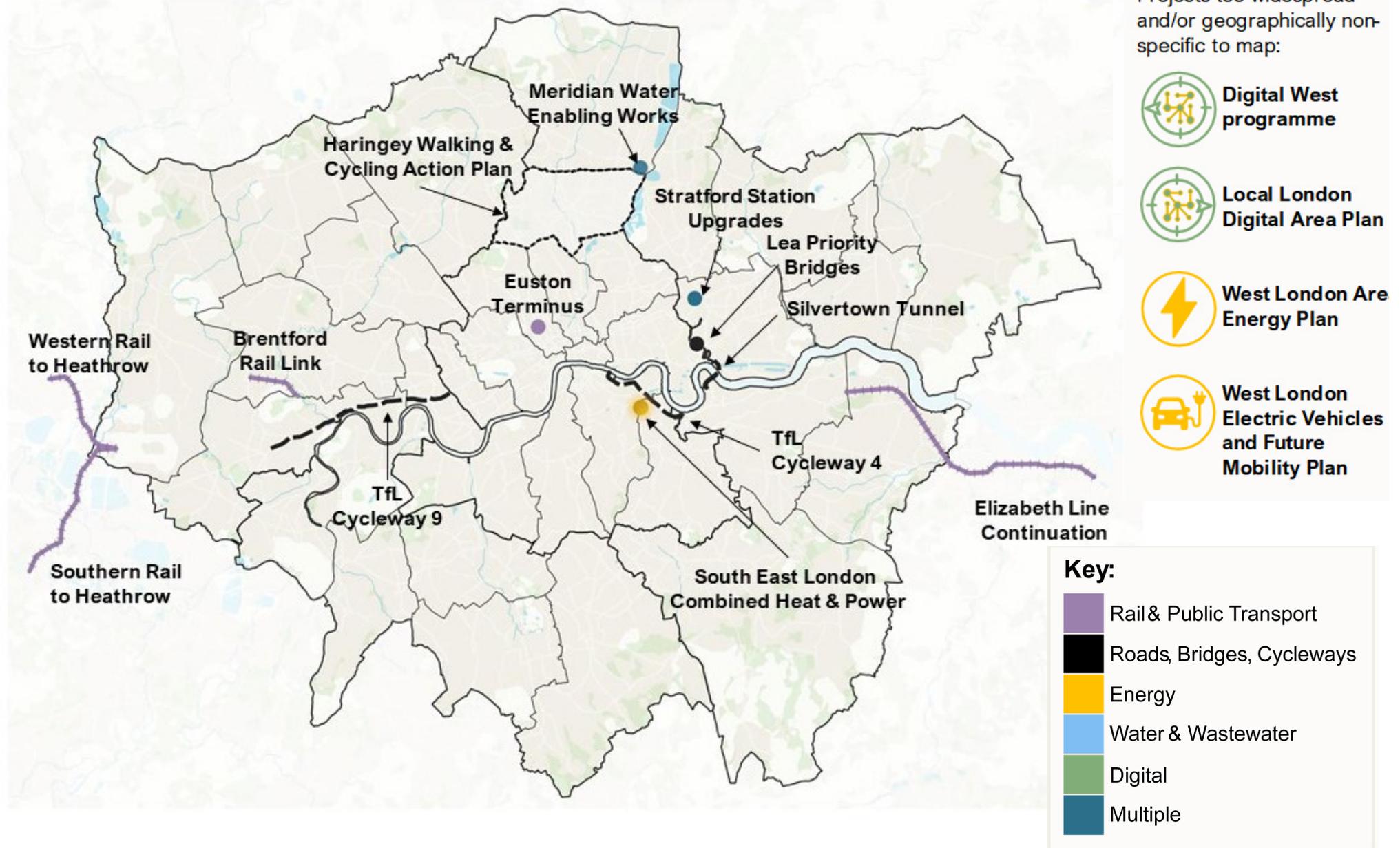
The **West London Electric Vehicles and Future Mobility plan** responds to emerging electric & hydrogen HGV developments through a consistent West London approach. This plan will focus on rapid super charging hubs and induction charging at Opportunity Areas with potential initial focus at OOC/ Park Royal & Great West Corridor.

South East London Combined Heat and Power (SELCHP) Extension will extend the SELCHP facility heat network west towards the Old Kent Road regeneration area and onwards to some of the large housing estates in Peckham. SELCHP is a waste incinerator in Lewisham which generates heat and electricity.

³¹ The Haringey Walking and Cycling Action Plan has been highlighted in this category as a potential exemplar of a type of project that is being developed in boroughs across London. Others are similarly leading, but were not submitted for review in this iteration of the infrastructure framework. The purpose of highlighting this project specifically is in part to recognise its level of development, and also to demonstrate the strategic import of these types of projects on the whole.

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Figure 15 Sub-Regional Exemplar projects





Growth Catalyst projects

Growth Catalysts are infrastructure projects with significant potential to unlock local economic growth opportunities such as housing, social infrastructure, and employment. These projects frequently relate to the key regeneration schemes and opportunity areas highlighted in figure 11, for example the package of transport infrastructure improvements around Old Oak Common. A number of projects in this category include Transport for London as a partner, and in some cases have been stalled as a result of changes to TfL’s funding settlement.

This strategic link to key regeneration schemes creates a strong case for investment for projects in this category through the creation and unlocking of additional benefits beyond that which could be achieved by either the regeneration or infrastructure project individually. This means that some of the projects in this category are more immediately appropriate for private sector investment, or to partnerships with other public sector development bodies like Homes England.

25 of the 67 shortlisted projects fall within this category (figure 16), representing the largest of the four groupings, including a number of site-specific projects as well as more extensive TfL line upgrades which increase transport capacity and therefore support further development and population density.

Many of these projects are underpinned by transport infrastructure, for instance HS2 linking to Old Oak Common and Park Royal, Elizabeth line extensions or major station redevelopment works like Waterloo City Hub and Harrow on the Hill.

Harrow on the Hill Station

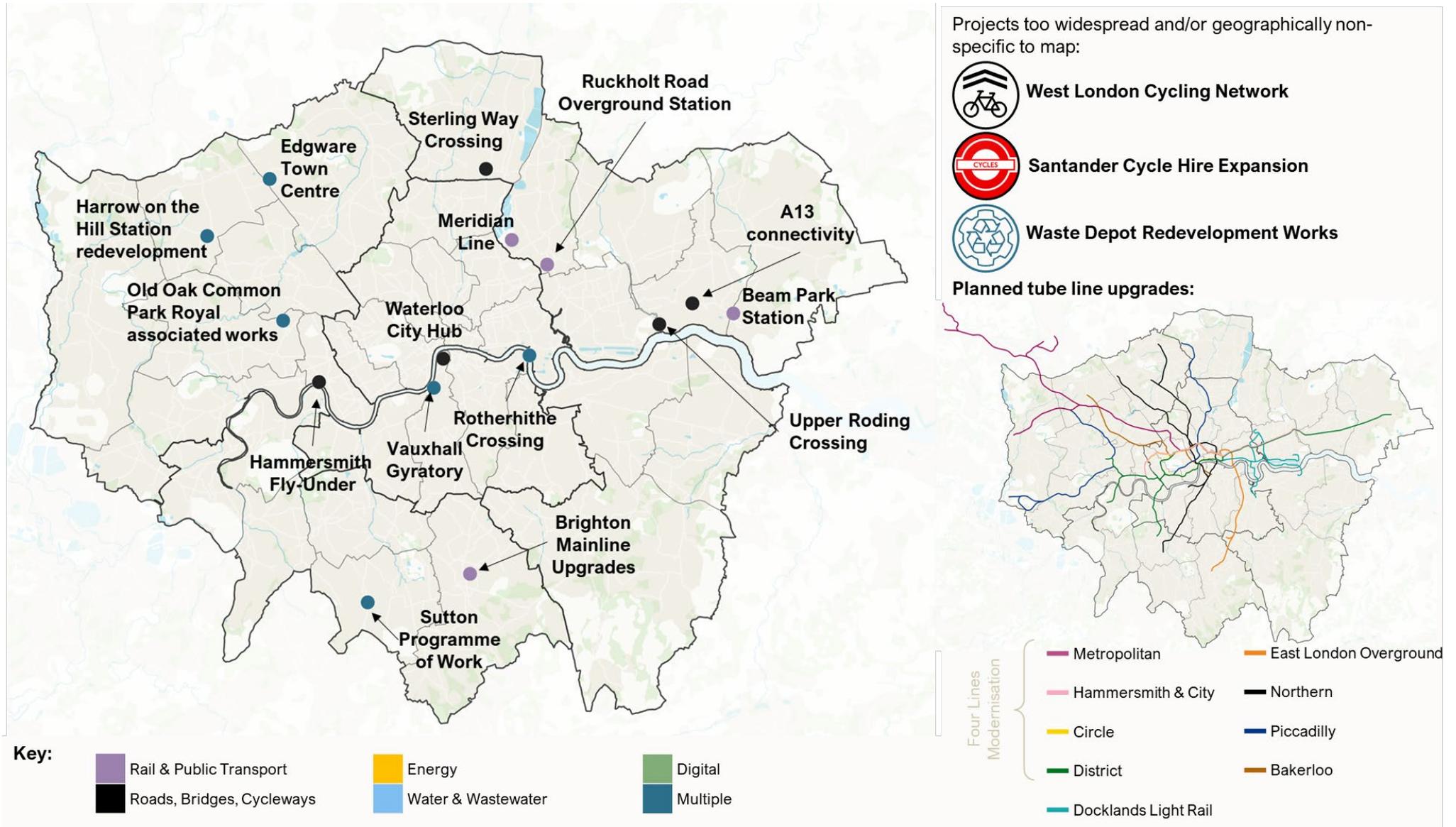
Redevelopment is a joint exploration between the London Borough of Harrow and Transport for London of a comprehensive residential led mixed use redevelopment of the bus station, underground station approach, together with land to the north and south of the station with improved infrastructure and new public realm with potential to unlock delivery of 1000 homes.

The **Four Lines Modernisation** programme is a £4.5bn TfL investment transforming the Circle, District, Hammersmith & City and Metropolitan lines through fleet, track, and signalling upgrades to increase capacity up to 32 trains per hour in Central London during peak times and boosting reliability - making journeys faster and more comfortable.

The redevelopment of **Vauxhall Gyratory** into a new layout will enable the delivery of two significant regeneration sites, together providing significant new office and commercial space as well as hundreds of homes. This will create thousands of jobs in construction, as well as making movement around Vauxhall safer and more sustainable.

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Figure 16 Growth Catalyst projects



Source: Metro Dynamics (March 2023)



Strategic Pilot projects

Strategic Pilots are typically smaller scale projects primarily focused on testing and implementing new or innovative approaches to delivering infrastructure.

While their initial impact may be relatively limited, they have the potential to tackle specific local problems, whilst also inventing new approaches that could be scaled up if successful and rolled out across London if proven viable. 11 of the 67 shortlisted projects fall within this category (figure 17). While this is not an exhaustive list of all small-scale innovative projects, Strategic Pilots are representative of the types and breadth of innovation taking place across London, especially considering the types of new approaches which look to tackle major challenges faced by cities across the world.

This category is intended specifically to identify projects that are piloting new approaches to delivering the just transition³², reducing carbon emissions and increasing adaptability to climate change or different approaches to transportation. It contains a mix of modern solutions to existing infrastructure challenges plus innovative concepts that do not yet exist in London or, in some cases, the world.

Many of these projects have been developed to explore modern, efficient and renewable ways to deliver energy or reduce energy requirements across London. This includes the North London Heat and Power project (EcoPark), both Haringey and Energetik Heat Networks and the South Westminster Area Network.

Other notable projects include Harrow’s feasibility study to investigate the concept of installing Plastic Roads which are 100% recyclable, defrost themselves, and generate renewable energy, which has the potential to change the way roads are built and maintained. Light Freight on the Thames introduces a concept stage reimagining of the way people and freight interact with the River Thames to promote a modal shifts from road heavy goods vehicles to commercially-competitive river freight. This would reinstate the River Thames as a major transport corridor, with potential benefits including reducing congestion and air pollution.

The **North London Heat and Power Project** will redevelop and expand the **EcoPark** in North London to provide flagship recycling facilities and a world-class energy recovery facility to treat non-recyclable waste in an efficient and environmentally friendly way. Construction commenced in 2019, expected to be complete by 2025. There is potential to connect the **Energetik heat network**, a city-scale heat network built with significant additional capacity to supply low carbon energy to connected homes and businesses by utilising waste heat from EcoPark. Estimates of Energetik’s capacity put it at around 60,000 homes.

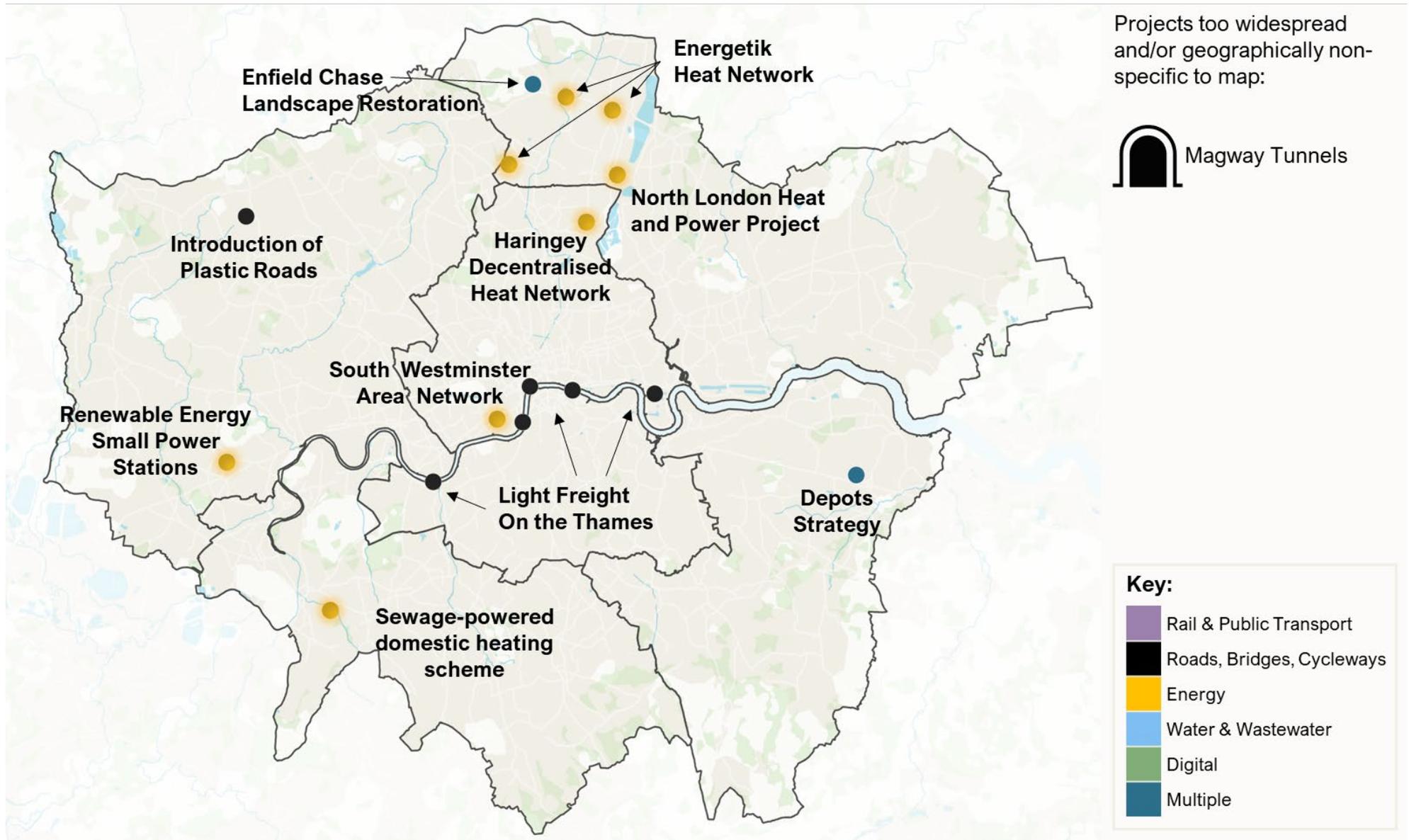
A **sewage-powered domestic heating scheme in Kingston** is looking to recover excess heat from sewage treatment processes to power more than 2,000 homes via a partnership between Thames Water and Kingston Council.

Light Freight in the Thames would reinstate the River Thames as a major transport corridor whilst generating additional economic activity and jobs within the marine logistics centre. This would involve the construction of new infrastructure and greater utilisation of existing infrastructure to enable modal shifts from road HGVs to commercially competitive river freight.

³² A just transition is one in which the substantial benefits of a green economy transition are shared widely across people and places, while also supporting those who stand to lose economically with viable economic opportunity. The term intentionally speaks to the dual pursuit of Net Zero and inclusive growth, within London and beyond.

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Figure 17 Strategic Pilot projects



Source: Metro Dynamics (March 2023)

Maintaining and developing the framework

Assembling information on current and planned initiatives has provided confirmation of the spread of projects currently planned to support London-wide priorities, as well as some important gaps in planning. While many of the projects in this framework are ambitious, they alone will not be sufficient to deliver on London's inclusive and sustainable growth objectives. There are important geographical gaps in strategic activity, and insufficient ambition around decarbonisation, local energy generation, and flood risk given the significant pressures faced across the city.

This section also presents a number of projects that have been stalled or significantly set back by changing funding circumstances in recent years. The reactive nature of infrastructure planning based on needs assessments and within the constraints of top-down funding allocations means relatively less coordinated development in the face of longer-term economic opportunities and pressures.

On their own, the projects and programmes identified here will not be enough to unlock the development opportunities needed to kickstart the economy in the near term, nor to meet long-term strategic objectives for a sustainable, inclusive and resilient London with benefits for all communities across an increasingly polycentric economic geography.

Fortunately, this is not a fixed process. The infrastructure framework is adaptable and capable of capturing additional projects, or of evolving over time if additional priorities or categories are needed to deliver on the overall economic vision for London. London Councils will maintain the infrastructure framework and provide biennial reviews of projects and activity that should be reflected.

Beyond the framework, work is needed to build capacity, capability, and coordination across London to develop more and transformational infrastructure. This must incorporate new concepts and methods, as well as maintain political buy-in at local, regional, and national levels. The remainder of this document sets out suggestions to support more ambition around the delivery of infrastructure, and suggestions for a more co-ordinated approach going forward.

5 Delivering infrastructure for the future

Meeting London's future challenges and opportunities will require cutting-edge and adaptable infrastructure solutions. Existing infrastructure must be upgraded to improve energy efficiency, increase resilience to sudden shocks and long-term stresses, and reduce emissions. New infrastructure must balance deliverability and accessibility with ambition and growth; funding and delivery models must keep pace with, rather than hold back, opportunities to advance strategic infrastructure provision.

London already has examples of innovative working to deliver infrastructure requirements. 3ci is building a national business case for a neighbourhood model of delivering housing retrofit requirements³³, and the Mayor of London has established a green bond to raise £500m of capital to invest in decarbonisation and other climate related projects in London.³⁴

Innovation will be vital to maintaining, adapting, and expanding infrastructure provision – both in terms of new technical solutions and also new delivery models and policy interventions. The forthcoming National Infrastructure Assessment will be exploring the need for a more strategic approach to delivering infrastructure, and how new models can be unlocked to enhance delivery and fuel the just transition as well as productivity growth. For London this will mean infrastructure investment that can support regeneration in growth areas associated with greater polycentricity, as well as more local energy systems that can manage both demand and supply more dynamically.

London has the track record, the assets and the scale to lead the development and adoption of these innovations, unlocking opportunities for the UK. This will include the development of new funding approaches, linked with fiscal flexibilities that utilise the proceeds of future growth for infrastructure investment.

Implementation solutions

While the London infrastructure framework largely focuses on the strategic relationship between infrastructure and economic growth, as well as models for collaboration and coordination needed to deliver on this strategic role, it is also important to highlight the role that new technical solutions can play in advancing infrastructure.

Major advances in infrastructure provision have already improved efficiencies, from using intelligent transport systems to work being done now to embed fibre connectivity across the TfL network. In the future, the Internet of Things will power smart buildings, in smart cities which are able to model the future and adapt to changing circumstances, for instance through the use of digital twins³⁵ of critical infrastructure. Construction will get faster, with 3D printing and modular design decreasing time needed on site. Hydrogen power could be an important ingredient in achieving a clean, secure, and affordable energy transition; the

³³ 3Ci (2021), [3Ci launched to help UK Cities attract global investment for Net Zero Projects](#).

³⁴ Mayor of London (2022), [Mayor announced £90m towards new green bonds](#).

³⁵ A digital twin is a virtual copy of a physical asset or system or environment that looks like and behaves identically to its real-world counterpart; the purpose of a digital twin is to run models and simulations to test existing systems to identify weaknesses, threats, and opportunities. Connected Places Catapult hosts the [Digital Twin Hub](#), with the intention of using these systems to promote climate resilience.

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Thames Estuary Growth Board is increasingly positioning itself as a driver of this innovation and establishing living labs to explore it further.

London should be a driver of new methods and approaches to delivering strategic infrastructure, building on its legacy of doing so, as well as research and development undertaken by education and research institutions and businesses within the capital. Cutting edge research should be supported to translate into real-world solutions, with London as a testbed for proving new technologies and interventions that go on to benefit the rest of the UK and beyond. London needs an enabling policy environment and the skills to support new approaches, including the likes of those shown in figure 18.

Figure 18 Selected examples and suggestions of new approaches to delivering infrastructure to meet future requirements

Possible delivery improvements:	Possible regulatory or policy-based improvements:
<ul style="list-style-type: none"> • Embedding a London-wide requirement that all development and construction projects look to replace any dug-up surfaces with more permeable materials in order to reduce surface water flood risk. • Shared facilities for processing multiple forms of waste at once, including integrated processing for reuse, refurbishment and circular repurposing of waste materials. • Shared resource for considering novel infrastructure solutions across boroughs, for instance heat networks which require specialist assessment as well as commercial models that are not currently standard practice for local authorities. • Expanding carbon capture capacity, with potential to link to freeports' role. • Developing and marketing waste-derived building and insulation materials if they could be proven to be effective and value-for-money. 	<ul style="list-style-type: none"> • Increasing the standards for anaerobic digestion in wastewater treatment plants in order to create the possibility of processing food waste in the same facilities. • Supporting transport delivery organisations such as DfT to establish formal joint delivery partnerships with boroughs and development partners/investors to ensure that infrastructure is delivered in a way that not only ensures efficiency but also imparts wider economic value; for instance developing new stations in such a way that the vertical building opportunities above them for mixed-use or housing provision are developed simultaneously with the station development as relevant, now that most of these are now rightly built with the stronger foundations that can support this. • Implementing infrastructure trading credits between boroughs, for instance for stormwater, to incentivise more mutual action on issues affecting individual boroughs.

Adopting and mainstreaming digital and other new technologies, as well as an enabling policy environment, will be essential to accelerating infrastructure delivery and ensuring it is adaptable to its changing environment. Exploring new approaches is essential to finding efficiencies and to meeting future needs, but it is important to note that novel approaches will inherently carry more risk.

A pan-London or shared approach to managing and sharing this risk will be vital for new approaches to succeed, ensuring that innovation and adaptation of both technical solutions and financial models can be managed in ways that benefit all of London. To do so requires specialist skills, not only to identify and implement novel technical solutions, but also to continue to ensure there are robust financial and commercial models underpinning interventions which require significant investment from multiple funding sources.

Funding & delivery models

This framework is not a formal and specific funding strategy, nor a specific route to market for any of the projects presented in Section 4. The types of infrastructure projects identified within and relevant to a pan-London approach are too varied and too complex for a single approach to delivery. But the framework does consider how the capital could be supported to develop and deliver ambitious infrastructure going forward.

Strategic infrastructure is costly and time consuming; from initial concept to planning and delivery these projects can take decades, and millions of pounds can be spent on scoping and management before construction even commences. Consideration and creativity are required to identify and unlock the right sources of finance, funding strategies and delivery models to advance strategic infrastructure. Over time, many of models and mechanisms for these have been used throughout the UK, to varying degrees and with varying levels of success.

Figure 19 Core components in funding and financing infrastructure



The appropriate source of finance for a specific intervention depends on whether there is a market failure (in which case responsibility falls to public sector), or whether there is a market incentive to delivery (in which a private sector provider will fund). In practice, infrastructure investment is not always so binary, and there is often the potential for a mixed model which combines resource financing to identify the best-fit solution, draw down public sector grant or de-risking investment, and then private sector finance based on a clear funding strategy.

Traditionally, infrastructure has been financed mainly by the public sector through grants and direct investment,³⁶ though in the current economic climate grants are highly constrained and government investment is increasingly looking towards opportunities to support levelling up by investing outside London.³⁷ The fragmented nature of government grants and bidding processes is a drain on already-limited local capacity, and short-term competitive bidding pots are not likely to be sustainable solutions for long-term and transformational projects. At the same time, the upfront costs of identifying repayment mechanisms from infrastructure projects have historically disincentivised private sector investment in infrastructure

³⁶ Government has in the past shown a commitment to addressing infrastructure issues with a number of programmes aimed at encouraging sustainable development, for instance: Housing Infrastructure Fund, Home Building Fund, Affordable Housing Programme, Growing Places Investment Fund, Brownfield Land Release Fund, Green Heat Network Fund, Levelling Up Fund.

³⁷ The UK Infrastructure Bank (UKIB), established in June 2021, will be the government's primary conduit for investing in large scale infrastructure interventions going forward. Its primary objectives are to drive the Levelling Up agenda and support efforts to tackle climate change. It has requirements to deliver a positive financial return at portfolio level, but also has remit to balance standard risk and return measurements with concessions related to their policy goals.

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development. This is starting to change, with private sector and institutional investors looking to tap into long-term opportunities as long as reliable funding strategies can be established.

London is in a unique position to explore novel approaches to capturing the proceeds of growth in order to increase the amount of finance available today for strategic, long-term interventions. This would be appropriate for a city of its scale and global significance; government in the UK is highly centralised compared to international comparators and most other global cities have many more tax revenues and flexibilities available to them.³⁸ Without these levers, London's independence and agency to invest in infrastructure is notably constrained.

The strategic categories of projects used in this framework and presented in section 4 are not defined by the forms of finance and delivery models that could be applied to them. Many could benefit from multiple tools and mechanisms, some of which are already common practice, and others that have been used in limited cases in the past but could be used more in the future. The Pan-London Exemplars and Sub-Regional Exemplars are of sufficient scale to more than likely require upfront public finance to be viable. Growth Catalysts and Strategic Pilots are more likely to be viable for new forms of delivery vehicles and models, bringing together public sector capacity with private sector capabilities.

There is no definitive rule on the types of projects that will be suitable to private or blended finance. Maintenance and demand management initiatives (described previously in figure 9) will typically fall to the public sector to finance, whereas adaptation and the provision of new infrastructure present opportunities for more bespoke funding solutions. Across the specific types of infrastructure covered in this framework the range of funding models and financiers possible is even more complex, depending on the nature of market failure and the viability of identifying repayment sources. This can be made even more difficult by the tendency of financiers to treat investment in each type of infrastructure as separate from the others, instead of holistically.

Figure 20 Funding approaches to different infrastructure types

Transport	There are more established models for private sector co-investment in transport, with funding strategies based on tools like community infrastructure levy and section 106, user fees ³⁹ , bonds, value capture, and hypothecated tax, including from council tax precepts and/or from tax increment finance (TIF). ⁴⁰ The maturity of funding strategies for transport infrastructure is in part reflective of the strong relationship between transport improvements and wider regeneration opportunities, which spark
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³⁸ London Finance Commission (2017). [Devolution: A capital idea](#). The report of the London Finance Commission.

³⁹ Charging users a fee for use of certain infrastructure, such as tolls on roads or bridges, can help to generate revenue to fund the maintenance and improvement of the infrastructure. The Dartford Thames crossing and the potential new lower Thames crossing utilise this mechanism.

⁴⁰ TIF has mainly been accessed via enterprise zones, with Birmingham city centre's enterprise zone enabling a £119m TIF scheme. Nine Elms' enterprise zone activated a TIF mechanism to help fund the extension of the Northern Line. The London Borough of Barnet and the GLA agreed a significant non-enterprise zone TIF model with government in 2015, enabling £97m towards a new Thameslink station at Brent Cross (though this was subsequently converted to partially repayable grant); the London Borough of Croydon and the GLA agreed the largest non-enterprise zone TIF model in 2018, enabling £309m towards a range of infrastructure interventions.

	<p>investor interest and illuminate repayment opportunities beyond the infrastructure itself.</p> <p>The decades-long project to deliver the Elizabeth Line was funded by a combination of public and private sources, with the majority of funding coming from Transport for London, the Greater London Authority, and businesses located along the route. Private funding came from the Crossrail Bond and other sources such as the Crossrail Property Bond, the Crossrail CRL Bond, and the Crossrail CRL Bond Plus.</p>
Digital	<p>Financing digital communications infrastructure is a less mature practice in the UK, but a growing market, with debt financing increasingly attractive and more investors looking to finance digital infrastructure assets. Compared with other sectors, data consumption and internet growth are fairly sure bets, and lenders are providing increasingly sophisticated financing packages to maximise debt capacity. The delineation between digital infrastructure and private equity investing is also less distinct as time goes on, with infrastructure vital to supporting commercialised digital innovation.</p>
Energy	<p>Risk and uncertainty can be deterrents to private sector financing of energy infrastructure, which has historically been provided by the public sector with partnership working reserved more for the management of the energy system, including energy supply and provision to homes and businesses, than for the provision of physical infrastructure itself. But the scale of investment in renewable energy infrastructure required highlights an opportunity for private sector finance if risk can be adequately encapsulated and mitigated; funding strategies for repaying upfront private finance might include through fees and charges, service incomes, or hypothecated tax.</p> <p>There is some risk that the private market for renewable energy matures faster than public sector models can keep pace, creating some risk for local authorities and public sector organisations entering partnerships without understanding full risk and financial models. Investor dialogue as part of the process of developing this work, including through an investment roundtable, has highlighted growing investor interest in neighbourhood heat network project opportunities. This is an area where capacity, skills and knowledge will best be pooled between several Boroughs, with the GLA and London partners to create the scale appropriate to this opportunity.</p>
Water	<p>Water infrastructure is long-lived and capital-intensive with high sunk costs, calling for high initial investment followed by very long pay-back periods; its benefits are difficult to monetise, undermining potential revenue flows.</p>
Flood risk management	<p>Flood risk mitigation is at present likely only viable for public sector financing, and the nature of the tragedy of the commons⁴¹ around flood risk actually means it is most likely to require grant and subsidy rather than repayable investment. Crowdfunded solutions by local households and</p>

⁴¹ The tragedy of the commons occurs when individuals act in their own interest when it comes to use of a public resource, as a result depleting the resource as a result of lack of ownership or accountability. In terms of flood risk, this phenomenon transpires because while everyone in an area affected by flooding is disbenefitted by it, no single individual or organisation is legally or financially responsible for mitigating the risk.

	businesses could provide a more bottom-up solution; but crowdfunding for infrastructure interventions carries some risk of exacerbating inequalities between places, with wealthy areas funding improvements while poorer areas are unable to raise money for projects.
Waste management	Waste management has historically only been viable for public sector financing, but there are opportunities to mature the market for recycling and the circular economy, which could make private sector co-investment increasingly viable and even attractive.

Securing a robust funding stream and setting up a fit-for-purpose delivery vehicle with necessary executive powers, can enable both the public and private sector to come together to support delivery for major projects in London. Access to these funding streams, and the ability to commit them to a delivery vehicle in a secure way, is vital to ensuring infrastructure is delivered in a viable and affordable manner.

London is a global city with a notable track record of delivering transformative infrastructure, and the scale to develop infrastructure solutions that can benefit its population, its environment, and the national economy. But in a constrained national funding environment, it needs to be empowered to advance strategic infrastructure investment through increasingly locally and regionally driven means. At present, the UK’s local government funding system is one of the most centralised in the world, limiting local autonomy and flexibility when it comes to crafting fit-for-purpose funding models. Some of the tools and mechanisms that could support this in future are summarised in figure 21.

Figure 21 Tools and mechanisms in funding and delivering infrastructure

	Sources of Finance	Funding Strategies	Delivery Models
Standard practice	<ul style="list-style-type: none"> Prudential borrowing Capital receipts Government grant or investment Institutional funding (both UK and International) Banks Equity investment 	<ul style="list-style-type: none"> Developer contributions (s106, CIL) Government grant or investment Guarantee schemes Residential rental streams (affordable, private sector) Fees and charges Equity returns Service incomes 	<ul style="list-style-type: none"> Development vehicle Council-led development HRA development Public sector loans to developers Private Sector delivery
Building on precedent from within London and elsewhere		<ul style="list-style-type: none"> Retained business rates; tax increment finance New homes bonus Roof tax Profit from private sales Hypothecated council tax Council tax precept Land Value Capture 	<ul style="list-style-type: none"> 100% owned subsidiary 50/50 JV company ESCO/MUSCO Development Corps Revolving investment fund

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To go further, London, Government, investors, and partners need to work together to unlock new funding and delivery solutions that can activate significant opportunities and support the achievement of London's economic framework. This will mean engaging in a mature conversation about risk and capacity; advancing new infrastructure interventions imparts both delivery risk and funding risk, which needs to be adequately captured and managed, whilst at the same time promoting agility and exploration of new solutions.

This is why London is rightly committed to exploring forms of fiscal devolution, as set out in the London Finance Commission, which would enable the capital to fund more investment through capturing the proceeds of future growth. Borrowing against business rate retention or value capture financing⁴² are two relatively underutilised mechanisms that could be further supported to unlock investment in strategic infrastructure. The recommendations in section 6 outline the potential to expand financing and delivery capacity in London going forward through a new growth deal and partnerships.

⁴² Value capture financing has been used to finance projects like urban new towns, light rail systems, regeneration, and public parks, by capturing the future value created by a public project and using it to deliver upfront infrastructure. This structured approach works best where significant value will be achieved through upfront infrastructure intervention, for instance where it unlocks a number of large strategic sites. Land value capture has been used fairly extensively and with accepted models in places like Singapore and the United States.

6 A co-ordinated approach to advancing strategic infrastructure

Effective delivery of strategic infrastructure projects will be key to increasing London's productivity, unlocking development opportunities in the short term, maintaining its global competitiveness and reputation, and building towards the long-term vision of London as an inclusive, sustainable, and polycentric city with opportunities for all its residents. Well-designed infrastructure investments enhance functionality and connectivity, reducing production costs and increasing community welfare, whilst creating business opportunities and promoting productivity.

In an environment of political and economic uncertainty, but an increasing focus on driving policy intervention to support places outside London, it remains vital to plan for and deliver strategic infrastructure which unlocks economic opportunity. Building on its track record of delivery, tapping into cutting edge firms and research institutions, and reflecting its immense scale, London can be an exemplar and a testbed for activating new approaches to delivering infrastructure. This will enhance the capital's sustainability, create economic opportunities and benefits for its residents and for the national economy, and establish models that can be replicated throughout the UK and abroad.

The infrastructure framework set out here is an important asset for London; enabling the city to speak with one voice to investors and Government about the capital's infrastructure priorities. This work will be taken forward through:

- An up-to-date version on London Councils' website as a readily available resource for boroughs, investors, and businesses.
- Communication about pan-London infrastructure priorities via Opportunity London and at major investment events like UK REiiF and MIPIM.
- Regular updates to reflect new priorities and projects that emerge, many of which will rightly have an even greater emphasis on climate change and net zero transition.

The development of the framework has been an important process in its own right, involving a great deal of stakeholder, business, GLA, SRP, Leader and Borough collaboration. Maintaining this level of shared commitment and alignment across the London Leadership system will be vital. The rest of this chapter sets out what should be done to achieve this through setting out principles for collaboration and co-ordination in delivering strategic infrastructure as well as recommendations to:

- Develop necessary skills and capabilities to deliver ambitious infrastructure interventions.
- Establish a new growth deal proposition in order to increase investment and funding capacity.
- Explore a range of specific delivery vehicles around thematic infrastructure challenges.

Principles for infrastructure collaboration

A more effective and co-ordinated approach could set a national standard for increased agency and self-sufficiency in driving economic opportunity. This will require a coalition approach across shared objectives, a combination of skills across a number of disciplines, and the time and remit to be able to meet shared goals.

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While system capacity for collaboration has improved in recent years, with GLA embedding a team to support coordination of infrastructure across London, the landscape for infrastructure is still complex and difficult to navigate. A variety of providers are involved in designing, delivering, and maintaining strategic infrastructure, and likewise the sources of funding and political approvals are layered and difficult to navigate. TfL, historically a significant driver of infrastructure and development, has become more constrained in recent years and needs a longer-term funding settlement as well as a more supportive ecosystem.

The following principles should guide collaboration as well as support aspirational thinking around the role of infrastructure in delivering on London's potential as a globally competitive, inclusive, sustainable and resilient city with economic opportunities for all its residents.

Principles for strategic infrastructure development & delivery

- **A consensus-led approach should enable solutions and interventions that benefit all of London**, recognising that not every part of London will benefit equally from every arrangement or at each point in time.
- **Pan-London collaboration** should support parts of London with less capacity to develop necessary and strategic infrastructure interventions to meet the long-term vision of a thriving and polycentric economic geography.
- **Shared governance and accountability across London** should build on the economic collaboration that has developed since Covid and on the experience of Mayoral Combined Authorities. London Councils and the Mayor should seek to evolve London's economic governance so that it can more effectively lead and co-ordinate impactful investment.
- **London should become increasingly self-sufficient**, with the skills to share delivery responsibilities making it possible to progress strategic priorities even in a constrained public funding environment. London should work with national government to enable novel solutions, including the ability to retain and invest from the proceeds of local growth, as well as establishing of special purpose vehicles as needed to advance strategic priorities.
- **Fit-for-purpose solutions should be developed and applied to strategic infrastructure interventions** from a toolkit of potential technological and commercial solutions. Solutions that use a combination of mechanisms are both essential to accessing sufficient finance for major projects and to spreading risk effectively.
- **Risk can and should be shared across a number of partners**, and borne by the institutions best set up to manage it, rather than with a single authority or provider.
- **Long term strategic public private partnerships should create opportunities to optimise socioeconomic and environmental outcomes** over time, and clear ESG outcomes should be designed into each project as well as overarching delivery approaches to balance short-term delivery requirements with long-term economic aims.

A new growth deal proposition for London

Despite the commercial attraction of London to investors, the infrastructure investment that London needs will also require a new deal with Government. That is because public sector resource and funding will be needed to unlock these investment opportunities. This has been confirmed in the development of this framework, with a roundtable that brought together political and officer leads from across London with major investment and development partners to discuss scope and appetite for new ways of working together. Taking these

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relationships forward in a strategic way will mean building in long-term funding capacity with effective skills, resourcing, and the time to develop fit-for-purpose solutions.

Getting the right infrastructure investment for London matters for the UK as a whole, because of the outsized impact that London has on our national growth and net zero transition prospects. London accounts for 8% of carbon emissions and has the lowest per capita emissions of any region and will play a central role in helping the UK achieve its Net Zero targets. Productivity growth stagnation in London since 2007 cost the national economy £54bn in 2019 alone, which could have created £17bn extra in tax revenue; rising housing costs and constraints to development are one possible driver, which strategic infrastructure provision could help unlock going forward.⁴³ Infrastructure will also be vital to mitigating the effects of climate change while reducing carbon emissions and reaching Net Zero.

Infrastructure investment in London will be critical for sustainable growth and to support Levelling Up across the UK. The 3ci initiative already brings London together with other cities across to develop a long-term financing approach to local net zero transition. Mayoral Combined Authorities are rightly accessing investment funds and brownfield funding to support infrastructure investment, and the Trailblazer Deals embed further fiscal devolution to support this. The new deals for WMCA and GMCA announced in March 2023 take those mayoral combined authorities beyond the devolved authority that even London has access to, with single department style multi-year funding settlements from 2025, tax incentives through investment zones and growth zones, and CRSTS allocations through March 2032.

London needs to play to its strengths, fostering an environment in which major infrastructure projects contribute to the capital's overall economic growth and potential. To unlock the capital's economic and development potential, it will need to be empowered to bring forward investment opportunities by capturing the proceeds of future growth to generate additional economic output; otherwise, London is at risk of being left behind by a lack of fiscal autonomy that limits local capacity for strategic investment.

⁴³ Rodrigues, Guilherme; Stuart Bridgett (March 2023). [Capital Losses: The role of London in the UK's productivity puzzle](#). Centre for Cities.

Core recommendation

London should develop a new growth, investment and devolution deal proposition with a new gainshare principle based on London generating a higher rate of growth for the UK, in return for being able to retain and invest more of the proceeds of locally driven growth. This could look like the next step in fiscal devolution, building on the original London GLA settlement and the more recent Mayoral Combined Authority and Trailblazer Devolution Deals. It could represent the next phase in gainshare arrangements based on leveraging the value of future growth, to invest now in the infrastructure that can underpin that growth. This would then enable London to utilise a combination of local sources (including business rates retention and land value capture) to deploy capital across a range of development and infrastructure priorities across London. Establishing a gainshare-style investment fund function for London would require further investigation of anticipated GVA uplift to form the base of a compelling argument for local management and retention.

A core component of this London Growth Deal could be a dedicated revolving infrastructure fund function activating investments and then re-investing returns from taxes, fees, and land value capture into additional strategic infrastructure projects. This would need to include central capacity to customise funding models and manage risk across related but distinct projects, with the potential to cross-subsidise across projects with variable return expectations and timescales, and with pooled revenue funding and/or a portion of investment repayments covering upfront costs involved in designing effective delivery solutions. A RIF mechanism could also look to maximise investment of other public sector bodies, such as Homes England or UKIB, and even crowd-in private sector investment.

The proposed London Deal would need to be underpinned by the evolution of economic governance arrangements, building on the system collaboration for economic strategy that the GLA and London Councils have developed since Covid. This approach of enhancing regional investment capacity and autonomy should also include longer funding settlement periods for Transport for London, to enable the organisation to effectively invest in mixed-use projects that generate marketable returns predicated on transport improvements, above and beyond the capacity of its existing TTL Properties.

Specific delivery vehicles to deliver future infrastructure needs

The sheer size, scale and complexity of London's infrastructure needs, economic geography and governance structure suggests that London will need to develop a range of tailored and specific infrastructure delivery vehicles. The city has a history of having done this from the London County Council, GLC and GLA, to the LDDC, ODA and Old Oak Development Corporation. It will need to create a new range of joint delivery vehicles fit for the inclusive growth and net zero transition opportunities of the 2020s and beyond, tailored to address specific themes and requirements. They will need to embody innovation, complemented with specific capacity dedicated to advancing solutions across a range of themes where London has structural challenges or opportunities but no coordinated mechanism for addressing them.

Core recommendation

A range of partnership and delivery vehicles to create shared capacity and capabilities around specific infrastructure challenges and opportunities facing London. These special purpose structures could bring together critical capacity, skills, and funding from public and private sources at a range of scales depending on the levels of risk and scale of opportunity, and look to focus on themes related to implementing new technologies and addressing specific structural issues. Each would need to have sufficient finance strength, including through hypothecated funding, to support large-scale private sector co-investment.

They could bring together other funding partners from across the public sector, including utility providers themselves as well as Homes England or UKIB, as well as private sector partners both to provide investment capital and to provide expertise on technical solutions and development of commercial models. Initial delivery areas might for instance explore:

- Developing a commercial model and delivery approach for implementing heat networks across different parts of London, particularly considering that many boroughs do not have the capacity or skillsets required to identify best-fit technical solutions or to enter effective commercial arrangements with suppliers.
- Linking together multiple boroughs at a time to deliver EV charging solutions, recognising scale mitigates risk and can enhance viability for private providers, building on the offer already being developed by London Councils to support rollout of EV charging infrastructure across London boroughs.
- Scoping an appropriate commercial model for a local authority or set of local authorities to implement renewable local energy generation technologies with an understanding of how the organisation would then capture and accrue financial benefits from selling surpluses back into the energy system.
- Replicating the development corporation model that has been effectively deployed by OPDC and LLDC to activate design and delivery capacity around major infrastructure and regenerative opportunities, potentially particularly apt for delivering Growth Catalysts.

Developing shared skills, capacity, and capability

Increasing the development and delivery of strategic infrastructure will require a stronger network of skills and capacity across a number of critical areas. Over a decade of austerity has meant that capacity within local authorities and even regulated infrastructure providers is severely diminished, just as the likelihood of national funding, subsidy, and capacity is decreasing. Navigating options for advancing strategic economic priorities through the delivery of ambitious physical infrastructure is difficult, labour-intensive, and requires joined up working at scale.

Technical skills for assessing local need and developing standard infrastructure solutions are fairly well developed, but less so for the new technologies and types of interventions needed to support London going forward. Particularly for new types of interventions, for instance the design of heat networks or building EV charging solutions at scale, there is a short-term skill gap within local authorities that many individual boroughs in London will not be able to

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resolve. This is even more true when it comes to looking beyond technological solutions to the delivery and commercial models needed to take them forward. Local energy generation, for instance, creates a market opportunity for boroughs in which they could generate financial returns by selling surplus energy back into the network, but the commercial model for doing so is relatively under-explored.

There is no one-size-fits-all approach to financing and delivering major infrastructure projects. The many different types of infrastructure, different delivery scales, and complex network of public and private sector delivery partners ensures that most projects require bespoke funding models. Financial and commercial models in general require a specialist skillset to develop, to stress test, and to integrate into functional implementation plans.

The ability for public sector organisations to develop effective financial and commercial models is a vital one to unlocking further and more agile investment in infrastructure that need not all rely on the public sector balance sheet. Beyond this, a robust understanding of cashflow and development returns is essential to managing risk, identifying fit-for-purpose delivery models, and to bringing in multiple sources of funding, including from the private sector.

Building and retaining these types of specialist skillset is expensive and competitive. While some London boroughs have the resource and appeal to attract specialist capabilities, others struggle to compete in the labour market, or have operating finance constraints that means there are significant trade-offs to investments in one skillset when multiple are needed to meet London's long-term opportunities and mitigate its challenges.

Core recommendation

London should develop a central infrastructure development and delivery centre of expertise, bringing together GLA and London Councils capacity to share specialist knowledge across London. The centre would retain specialist skillsets and capabilities that could be deployed across boroughs throughout greater London, minimising the need for duplication in skillsets between boroughs whilst supporting places, and groups of places (including SRPs) that struggle to access specialist staff. Its focus would be on supporting the development of investable projects, innovative shared delivery models, and future facing sustainable energy solutions.

Conclusion

Infrastructure is vital to London's ongoing economic development, and to achieving the goals set out in the London economic framework of inclusive and sustainable growth across a polycentric economic geography. The infrastructure framework sets out a model for assessing the relationship of individual projects to the economic vision by categorising strategic infrastructure projects in a structure that will be maintained and refreshed biennially by London Councils. It concludes with a set of principles to take forward as well as core recommendations to build capacity, capability, and co-ordination.

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