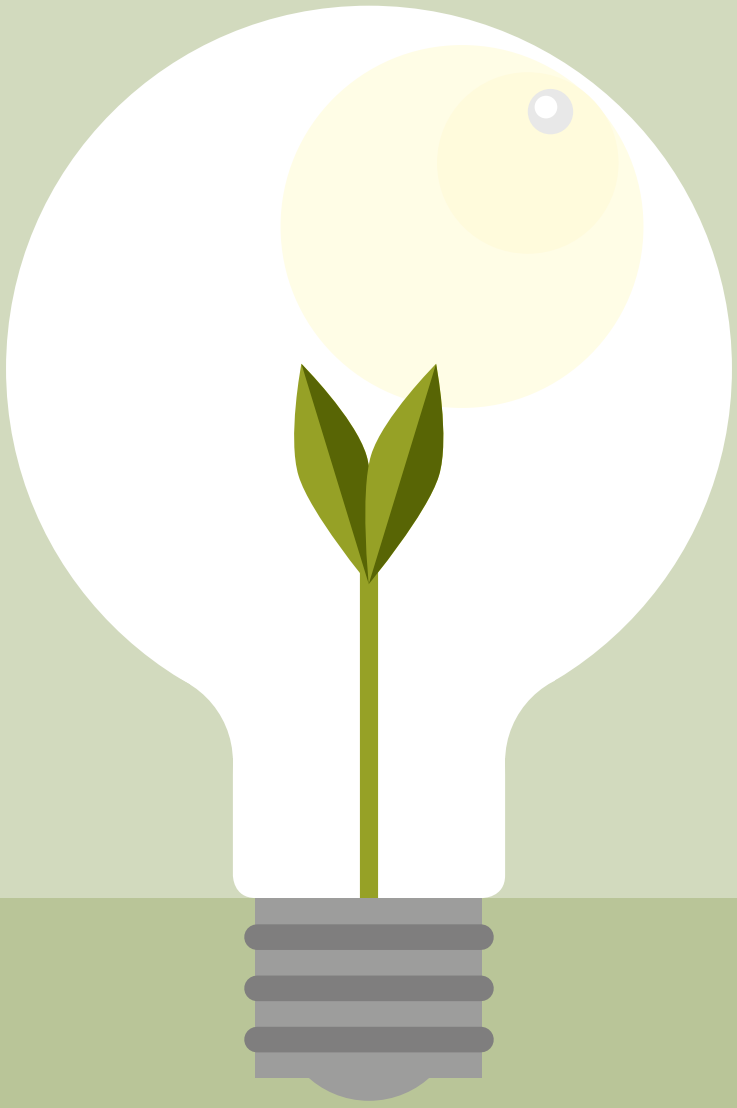
Natural Capital

Investing in a Green Infrastructure for a Future London



Green Infrastructure Task Force Report

Prepared by the Greater London Authority on behalf of the Green Infrastructure Task Force

Contents

Foreword

Matthew Pencharz
Chair of the Green Infrastructure Task Force

London is the world's greatest city. And it is a city growing the fastest in its history, by over 100,000 people a year, projected to have more than 11 million inhabitants by 2050. We are working to lengthen London's lead as the world's greatest city while accommodating this demographic growth.

As set out in the London Infrastructure Plan, the Mayor established the Green Infrastructure Task Force to identify how to encourage a more strategic and long-term approach to green infrastructure delivery and investment. It has brought a wide range of expertise and experience to our examination and discussion of the subject, with members drawn from boroughs, land managers, policy specialists, academics and NGOs.

What has become clear to the Task Force is that we need to make far better use of green infrastructure to meet the challenge of London's growing population. We need to plan, design and manage it better as a network, rather than simply as separate elements, such as individual parks, trees, rivers, and green roofs. This will only be achieved with a better appreciation of the benefits green infrastructure provides.

The work of the Task Force has revealed gaps in what we know about London's green infrastructure. London is lucky to have data on where elements of green infrastructure, such as parks, cemeteries and green roofs, are located. However, we don't yet understand the full potential of a well-managed green infrastructure to help address London's future environmental and social challenges. The Task Force has therefore set out where more information is needed.

The Task Force has also investigated how we can make a better business case for investing in green infrastructure. Work has already begun to develop new accounting methods that can properly value the functions of green infrastructure. Yet, there is more to be done to pilot this approach for London and make the practice mainstream. This report also identifies new ways to distribute funding and govern the network at different scales.

Through updated London Plan policies, the current Mayor has provided a basis on which to move forward with this important agenda. The report provides a number of case studies from London and beyond which we hope will inspire those looking for innovation and ideas. These include some from the programmes such as Drain London, the Big Green Fund and Pocket Parks that I have championed as Deputy Mayor for Environment & Energy, including Derbyshire Street Pocket Park and Firs Farm Wetlands. The work of the Green Infrastructure Task Force encourages everyone interested in London's environment (and transport, health, housing and education) to take on board the learning from these excellent initiatives.

As we head into a new political cycle it is important to remember that this agenda really matters to Londoners; the individual elements of green infrastructure (the city's green spaces, trees and waterways) are an important part of people's daily lives. The recent campaign to declare London a National Park City has gained widespread public and political support, demonstrating the high level of interest in London's environment. Implementing the recommendations of the Task Force's report will help deliver a more coherent, efficient green infrastructure that can create a more attractive, better connected, healthier, and more resilient city that people can take pride in.

Chairing the Task Force has reinforced my views of the importance and potential of London's green infrastructure to help address London's environmental and social challenges. I would like to take this opportunity to thank all of the Task Force members for their contributions, to those who submitted evidence and case study material, and those who have commented on drafts of the report. Our work does not finish with the publication of this report and we welcome responses to our recommendations.

Matthew Pencharz
Chair of the Green Infrastructure Task Force

A Vision for the Green Infrastructure of the Future City

A high quality and well-maintained green infrastructure is integral to keeping the city healthy, happy, moving and functioning. By 2050, all neighbourhoods will be able to benefit from, enjoy, and take pride in London's green infrastructure.

Communities will use safe green routes for walking, cycling and exercise throughout the city. Green infrastructure will help ensure London's resilience to climate change, and contribute to a significant improvement in the quality of London's air and river-water. The ecology of the city will be richer and Londoners will have better access to nature.

New funding models will be in place that are informed by green infrastructure's key functions, and determined by the geographies that are best able to maximise the benefits of green infrastructure. Decision-makers will recognise that green infrastructure is a necessity for sustained economic growth and high quality of life.

What is Green Infrastructure?

Green infrastructure is the network of green spaces (as well as features such as street trees and green roofs) that is planned, designed and managed to deliver a range of benefits, including:

– healthy living;
– mitigating flooding;
– improving air and water quality;
– cooling the urban environment;
– encouraging walking and cycling; and
– enhancing biodiversity and ecological resilience.

By 2050:

– Existing parks and green spaces will become part of an integrated green infrastructure network that is planned, designed and managed to deliver strategic functions as well as local needs. It will link seamlessly with a green infrastructure beyond the London boundary.
– All regeneration areas and major new developments will include green infrastructure (such as green roofs and walls) that is designed, amongst other things, to keep the city cool, to manage stormwater and to promote health.
– Many streets, including high streets, will be transformed into greener areas of public realm where walking and cycling will have priority.
– More of London's hidden rivers will have been removed from pipes or concrete channels to manage flooding, improve water quality and enhance river ecology.
– All Londoners will have accessible, good quality green infrastructure nearby that they can take pride in.
– We will be making green infrastructure decisions based on natural capital valuation.

Queen Elizabeth Olympic Park legacy visualisation.
© Arup/London Legacy Development Corporation

Executive Summary

"If you were to look down at London from the stratosphere, you would be struck by how green it is, with a plethora of green and open spaces, formal and informal, large and small, helping to define and shape the form of the city. Down here on the ground, we look to these spaces for all that they add to the quality of the particular places we live in, work in or visit.

What we aim to do is look at them in a joined up way, making sure the contribution they make to the quality of life, to the environment and to the economy are maximised.

The term "green infrastructure" may sound odd, but given the scale and range of benefits these spaces give our city and its neighbourhoods, it is vital we see them as being as integral to the capital's metabolism as its roads, rail lines and water pipes."

Mayor's Foreword to the All London Green Grid Supplementary Planning Guidance (March 2012)

London continues to grow at an historic rate. It surpassed its previous 1939 population peak of 8.6 million at the beginning of 2015, and is projected to continue its unprecedented phase of growth to reach over 11 million inhabitants by 2050 (a 37% increase from 2011). To accommodate this population growth, London will need around 50,000 new homes each year.

To ensure it remains the greatest city on earth, in the context of such levels of population growth, climate change, and other environmental challenges, London needs world-class infrastructure. This level of growth requires us to reshape the city for the 21st century and beyond, which has been recognised in the Mayor's London Infrastructure Plan 2050.

The Plan recognises that investment in London's 'green infrastructure' is required alongside investment in the transport, water, energy and other infrastructure that we commonly associate with successful cities. Recognising and making the most of the potentially enormous benefits of a well-planned, designed and managed green infrastructure can lead to a more productive city that is environmentally, socially and economically sustainable. Investing in green infrastructure can help ensure that London will be a city where everyone's quality of life improves as the city grows. It can also help the city to be prepared for the potential impacts of a changing climate.

London is already a green city, with over 47% of its area classified as green or blue, and with over 8 million trees. Until recently, however, green infrastructure has often been considered in isolation as utilitarian spaces, rather than as an integral part of the urban environment alongside the roads, railways, cables and pipes upon which the prosperity and viability of the city depends. As a result, the potential benefits that green infrastructure can provide have been largely under-appreciated and unrealised. Green infrastructure is an urban infrastructure that has been hidden in plain sight.

However, the opportunities that come from viewing green infrastructure as a network that forms an integral part of the city are immense. This report makes the case that we need to, and can, deliver green infrastructure that helps address the socio-economic and environmental challenges that London faces. This will require more than simply maintaining and improving the use and aesthetics of London's existing green spaces.

We need to reconsider the roles and purposes of many of our urban green spaces (for example, by combining recreation with flood risk management, or heritage with urban cooling) and to consider their configuration, just as we regularly upgrade or modify other forms of infrastructure. We also need to consider how to fill the gaps in our green infrastructure by incorporating it into buildings, and to explore how the grey infrastructure of our streets and public realm could be greened. We need to fundamentally rethink the way we plan, design, manage and fund the city's green infrastructure.

The concept of green infrastructure provides a stronger justification for the protection and management of the city's green spaces. It argues that the purpose of individual spaces – and the network as a whole – must be designed and managed to address current and future urban challenges, rather than simply reflect their historic design and use.

Those responsible for making key decisions about London's infrastructure should acknowledge that the green parts of the city will need to provide a wider range of benefits for Londoners and the city's economy. They should also recognise that this green infrastructure needs to be planned, managed and funded like other essential infrastructure.

Green Infrastructure Goals

The Task Force's vision is for a high quality and well-maintained green infrastructure to help keep London healthy, happy, moving and functioning. By 2050, all neighbourhoods will be able to benefit from, enjoy, and take pride in London's green infrastructure *(see Vision, page 2)*.

The Task Force has considered how to measure progress in achieving this vision, and has proposed a preliminary set of green infrastructure goals for a future Mayor.

By 2050:

- London should maintain its status as one of the world's greenest capital cities – 50% of the administrative area should be green infrastructure. This would require an increase in green cover of approximately 9000ha – three times the area of the London Borough of Haringey.
- London should maintain its "urban forest" by increasing tree cover from 20% to 30% of London's area – continuing to have one tree for every Londoner as the population grows.
- 80% (9 million) of Londoners will be walking, jogging or cycling at least 2 miles per day.
- Surface water flows into the sewer network will be reduced by at least 25%.
- EU standards on water quality will be met for all of London's rivers.
- At least 20% of London's area will be designated of high wildlife value.

What Needs to be Addressed?

Section One

Rethink Purpose: Defining Green Infrastructure

London has boasted an extensive network of parks, green spaces, trees and gardens since at least the 19th Century. Nevertheless, green infrastructure is a relatively new concept and has been defined and interpreted in various ways. We propose an explanation that is especially relevant to the future of London and other cities.

We propose that green infrastructure in a future city should be informed by and deliver the following five objectives:

1. **Promoting Healthy Living** – improving health outcomes by increasing physical activity, reducing stress and removing pollutants.
2. **Strengthening Resilient Living** – keeping the city cool, its air clean, and protecting it from flooding.
3. **Encouraging Active Living** – increasing levels of walking and cycling.
4. **Creating Living Landscapes** – enhancing natural processes for the benefit of people and wildlife and conserving the most special landscapes, habitats and species.
5. **Enhancing Living Space** – providing a range of outdoor space for cultural, civic, learning and community activity, including productive landscapes.

This provides a stronger justification for the protection and management of the city's green spaces. **The purpose of individual spaces, and the network as a whole, must be designed and managed to address contemporary and future urban challenges, rather than only reflect historic design and use.**

Section Two

Reframe Value: The Benefits of Green Infrastructure

"Our work not only shows that the economic returns of environmental investment are comparable and sometimes greater than those of conventional infrastructure investment, but also that the cost of not taking action can be huge."

Final Natural Capital Committee Advice to Government (September 2015)

A considerable barrier facing green infrastructure is our inability to account for its social, environmental and economic value in ways that can help inform decision-making. Traditional business case metrics are not very good at measuring the benefits resulting from complex interactions, environmental externalities or benefits that cannot be readily measured in monetary terms.

As a result, one of the most powerful arguments in favour of green infrastructure – the provision of multiple benefits – works against investment in green infrastructure. This is because it is often difficult to link the specific cost of investment to the overall value of the different outcomes. This issue is being addressed at a national level through the work of the Natural Capital Committee (the Government advisors on the economics of the environment) through, for example, testing new accounting frameworks such as natural capital accounting.

New approaches to properly valuing the services and benefits provided by green infrastructure are reliant on access to good quality data. London is fortunate in having Greenspace Information for Greater London, an environmental records centre that collates and manages datasets on the type and composition of London's green infrastructure alongside data on habitats and species. However, data on the quality, functions and uses of London's green infrastructure is much more limited.

Those who own and manage London's green infrastructure should value it for the full range of benefits it provides. Decisions on funding and investment should be made on the basis of properly valuing the benefits green infrastructure provides.

London also needs better data collection and management to ensure that the benefits of green infrastructure can be more effectively monitored and measured.

Section Three

Restructure Governance: Managing Green Infrastructure

Maximising the benefits of green infrastructure is also challenging because of the complexity in its ownership and management. A wide range of (largely public sector) organisations, with varying remits and responsibilities, has evolved over time to manage London's green infrastructure. In recent years, there has been a shift of management from the public sector to private and charitable sectors. For example, housing associations are responsible for significant tracts of social housing greenspace, and the voluntary sector has taken on the management of large areas of public land. Privately owned and managed green infrastructure (such as domestic gardens and green roofs) also plays an important role in the functioning of the network as a whole, but much of this sits outside of any strategic management framework.

This fragmentation results in much of the network being considered as a series of individual spaces with local, or at best borough-wide, objectives. The few exceptions are where organisations, such as the Lee Valley Regional Park Authority, provide sub-regional co-ordination and management. Yet green infrastructure functions often need to be planned and managed at different scales to those on which existing public agencies are based. For example, interventions to prevent flooding or improve water quality are best delivered at a catchment level that may cross several local authority boundaries.

Even within public sector organisations, the management of green infrastructure can be fragmented between different departments and teams. However, those responsible for highways, health and well-being, resilience and regeneration may be equally well-placed to drive forward the green infrastructure agenda as those responsible for planning and parks. For example, green infrastructure can help deliver public health benefits by encouraging physical activity or reducing air pollution; can support economic development by reducing the likelihood of flooding; or can promote social cohesion by improving the public realm and shared space. Changes in the structure of local authorities are beginning to break down traditional silos, and there are lessons to be learnt about which new approaches work best.

Many of the cities around the world of a comparable size or status to London have city-wide authorities that have responsibility for the development and management of the green infrastructure of their cities. Other UK cities, including Birmingham and Liverpool, are also developing city-wide green infrastructure plans, and the concept of London as a National Park City has gained both public and political traction.

The Task Force recognises that there is a need for better pan-London co-ordination, promotion and funding of green infrastructure that adds value to existing governance arrangements. Furthermore, some of the benefits and services provided by green infrastructure, flood management, for example, need to be considered in the context of geographies which extend beyond the Greater London boundary.

We propose the appointment of a Green Infrastructure Commissioner, together with improvements to local and sub-regional governance structures, to help raise the profile of green infrastructure in London and to improve the coordination of green infrastructure planning and funding.

Section Four

Release Funding: New Sources of Finance

Recent analysis to inform the London Infrastructure Plan explored the key issues presented by the funding and resourcing of green infrastructure. It highlighted the wide number of public and private stakeholders involved in funding and delivering green infrastructure, including those with a stake in housing, public health, transport and environmental protection, as well as those concerned with amenity, sport and recreation.

Furthermore, the management and maintenance of London's traditional green infrastructure has been subject to boom and bust cycles of public funding, i.e. periodic capital investment followed by often inadequate long-term maintenance funding. This has been exacerbated by the fact that green infrastructure provision is not a statutory requirement for local authorities.

Changing the way we value the benefits of green infrastructure will help address these problems. In this report, we describe some of the approaches advocated by the Natural Capital Committee and others. But it is also clear that new sources of funding and finance are needed. These include models that compensate for environmental loss or degradation, or leverage more private sector finance to offset the costs of upgrading more traditional infrastructure. We also suggest there may be scope to encourage more philanthropy with respect to supporting London's green infrastructure.

We encourage the Mayor and key stakeholders to establish new green infrastructure funding mechanisms.

Next Steps

The Task Force aims to encourage the shift in culture and understanding needed to put green infrastructure on an equal footing with London's other infrastructures. This report includes a wide range of recommendations that we think will help achieve this *(see page 8 for the full list of recommendations)*. The following headline recommendations are those that we consider should be implemented as a priority:

Appoint a Green Infrastructure Commissioner, who should initiate a public-facing campaign to raise awareness of the value and benefits of green infrastructure *(Recommendations 10 and 18)*.

Investigate opportunities to raise funding for green infrastructure, particularly:

- **Ensure a future Mayor continues to pump-prime green infrastructure projects at a level that matches or betters previous Mayoral programmes. This will support sub-regional partnerships to improve collaboration, co-ordination and delivery of green infrastructure** *(Recommendation 20)*
- **Create a Green Infrastructure Foundation and a Natural Capital Resource Fund to support the long term, sustainable funding of green infrastructure** *(Recommendations 24 and 25)*.

Update the All London Green Grid, based on new evidence and natural capital accounting or other valuation methodologies. This will inform green infrastructure delivery strategies for all opportunity areas, as well as inform new green infrastructure targets *(Recommendations 4, 5, 12 and 13)*.

'This report demonstrates that we can deliver a more coherent green infrastructure that will help meet the needs of a growing city, be better value for Londoners, and will ensure London's status as one of the greenest and most liveable big cities in the world.'

Summary of Recommendations

A Stronger Policy Basis for Green Infrastructure

1.
The Mayor should ensure that green infrastructure, based on the definition provided by our vision, is a key theme in the preparation of the London Environment Strategy, and relevant policies are updated in the London Plan review.

2.
The Mayor should ensure that there is a robust evidence base on which our proposed five strategic objectives can be measured and monitored.

3.
The Mayor should develop more definitive standards for green infrastructure, related to our proposed five strategic objectives, in the London Plan review.

4.
The Mayor should update the All London Green Grid Supplementary Planning Guidance, and replace the outdated Open Space Strategies Best Practice Guidance with guidance on green infrastructure strategies.

5.
The Old Oak and Park Royal Development Corporation should produce a green infrastructure plan based on our proposed five strategic objectives. The London Infrastructure Delivery Board should ensure that this approach is applied in other Opportunity Areas.

Improving the Design and Delivery of Green Infrastructure

6.
The Mayor and Public Health England should develop a pilot project to robustly test the ability of targeted green infrastructure improvements to deliver specific health outcomes and create savings for health budgets.

7.
The Mayor should work with Thames Water to maximise the opportunity for delivery of green infrastructure based SuDS through Thames Water's 'Twenty4Twenty' and successor programmes.

8.
The Mayor should ensure the target to increase green cover in the Central Activities Zone (set out in Policy 5.10 of the current London Plan) is extended to all areas of the city where higher density development is planned, such as Opportunity Areas.

9.
The Mayor should work with Transport for London to ensure green infrastructure is integrated into its future cycling and walking strategies, and related design guides.

10.
The Mayor should work with the National Park City initiative and other stakeholders to develop a public-facing campaign to raise awareness of the benefits of green infrastructure.

11.
The Mayor should develop a version of the Green Space Factor as a means to address deficiencies in access to open space and access to nature in the most densely developed parts of the city.

Highlighting the Value of Green Infrastructure

12.
The Mayor should work with the Department for Environment, Food and Rural Affairs, and the new Natural Capital Committee to ensure London's green infrastructure is central to the Government's national 25-year natural capital plan.

13.
The Mayor, London Councils and the City of London, should further test the natural capital accounting framework to determine its applicability to a portfolio of public sector green infrastructure assets and ensure this framework becomes a necessary tool for informing investment decisions.

14.
The London Enterprise Panel should help develop the frameworks for valuing green infrastructure to ensure that future investments take proper account of the potential for green infrastructure to deliver economic objectives.

Governing Green Infrastructure

15.
London boroughs should ensure that the concept of green infrastructure is central to a placemaking agenda and properly represented within their placemaking teams.

16.
The Greater London Authority, London Councils and the Environment Agency should review existing relevant partnerships to identify opportunities for better collaboration and co-ordination of green infrastructure.

17.
Boroughs should support sub-regional green infrastructure partnerships. These partnerships should be funded by the Greater London Authority matched by an allocation from the boroughs, for example, from savings generated through the reduction in the levy achieved by the Lee Valley Regional Park Authority over the past five years.

18.
The Mayor should appoint a Green Infrastructure Commissioner to advocate, promote and develop an integrated green infrastructure for London.

19.
London Councils Transport and Environment Committee should take a stronger role in promoting, co-ordinating and supporting green infrastructure.

Securing Green Infrastructure Funding

20.
The Mayor should continue to provide pump-prime funding that matches or betters previous Mayoral funding programmes to ensure a pipeline of good practice case-studies of green infrastructure design and delivery.

21.
The Mayor should ensure that green infrastructure receives a proportionate share of any infrastructure funds resulting from the proposals for further fiscal devolution.

22.
The London Enterprise Panel and the Infrastructure Delivery Board should ensure that green infrastructure outputs are delivered through other infrastructure funding for surface transport, high streets, housing and regeneration.

23.
The Mayor and London Councils should identify the scope for additional levies or compensatory mechanisms on environmentally detrimental activity that could assist in funding green infrastructure projects. These should include, for example, 'stormwater credits' and 'biodiversity offsetting'.

24.
The Mayor should explore with the National Park City campaign how a Green Infrastructure Foundation could be created and operated.

25.
The City of London, with support from the Greater London Authority, should undertake a study into the potential for a Natural Capital Resource Fund.

Introduction and Context

The modern concept of a park was first developed when the former Royal farms and hunting grounds (now the Royal Parks) began to be landscaped in the early 19th Century. By 1835, parts of Regents Park were opened to the public. The notion of a metropolitan park, as an accessible amenity space for all Londoners, was established with the opening of Victoria Park in 1843.

But it was during the middle of the 20th Century that the precursor of the concept of green infrastructure began to emerge. Starting with the so-called Abercrombie Plans of 1943/44[1] and running right through to the current London Plan[2], the city has had a land-use planning framework that protects and conserves the best of London's parks and green spaces. This approach has served us well; providing Londoners with opportunities for outdoor amenity and recreation, and protecting the heritage of natural and designed landscapes. It has provided a guiding set of principles, including access to green space standards, which are widely understood and supported. These will remain at the heart of city planning in the future.

Green infrastructure is a relatively new concept and has been defined and interpreted in various ways. However, none of the previous definitions of green infrastructure were satisfactory when describing the future potential of green infrastructure in London; they were either too generic, focused on one purpose, or relate to form rather than function. For green infrastructure to be regarded as being as necessary to London's future as other vital infrastructure, a better and more consistent explanation of the purpose and intended outcomes of green infrastructure is needed *(see box below)*.

What is Green Infrastructure?

Green infrastructure is the network of green spaces (as well as features such as street trees and green roofs) that is planned, designed and managed to deliver a range of benefits, including:

– healthy living;
– mitigating flooding;
– improving air and water quality;
– cooling the urban environment;
– encouraging walking and cycling; and
– enhancing biodiversity and ecological resilience.

London's Infrastructure

London continues to change over time. We are entering a new period of urbanism with a vision of a denser, smarter, electrified, less car-dependent city enabling a more sustainable future. London should be a city that can cope with a growing population and continued economic growth, whilst improving the environment and people's quality of life. Achieving this requires significant investment in upgrading and transforming London's infrastructure.

London's infrastructure is the physical components of networks or systems that deliver the services necessary for the city to function well. For example, roads, railways and stations allow us to move efficiently around the city; reservoirs, pipes and treatment works ensure a sufficient and suitable supply of water; and cables and wi-fi enable us to communicate quickly and clearly with huge numbers of people in multiple locations.

Infrastructure has generally been regarded as 'hard' or 'grey' infrastructure; engineered structures that provide specific functions to deliver dedicated services, such as electricity cables to deliver energy to provide power. Infrastructure functions and services are dependent on a set of components (assets) that must be maintained to remain reliable, and upgraded and adapted to respond to changing demands or circumstances.

Some are concerned that an increasingly urbanised city will lead to the inevitable loss of green spaces and a growing disconnection from nature. But new thinking is beginning to emerge, drawing on the principles of landscape ecology[3] and landscape design, which demonstrates that this need not be the case. The concept of 'green infrastructure' can reconcile the apparent conflict between bigger, denser cities and the desire to protect the green parts of the city, for example by showing that our network of parks, rivers, green roofs and street trees underpin the city's economic health. This approach is described in further detail in Cities Alive[4] (Arup, 2014) and promoted through the emerging 'nature-based solutions' policy framework[5] from the European Commission.

Green Infrastructure: A New and Necessary Way of Thinking?

With London facing the opportunities and challenges of continued growth, it is vital that we reconsider the purpose of the green parts of our city so that they are better able to provide the benefits needed by the citizens of a 21st century metropolis. We address this in Section 1 of this report, highlighting that green infrastructure should be considered through the lenses of health, transport, climate change resilience and social cohesion, as well as the more traditional perspective of sport, recreation and heritage. By doing this, green infrastructure can make a significant contribution to the efficient, innovative and inclusive responses to London's growth called for by the London Infrastructure Plan 2050 Update[6] *(see box below)*. It also ensures that the rationale for investment in London's green infrastructure becomes compelling.

London Infrastructure Plan 2050

"It is vital that infrastructure is prioritised and delivered in an inclusive way, with all Londoners benefiting from access to high-quality green space, good transport connections to work and leisure activities, and decent homes sustainably supplied with energy and water. It is also vital that efficiency and innovative thinking are integrated into all elements of infrastructure delivery to ensure that costs are minimised."

London Infrastructure Plan 2050 Update (March 2015)[7]

London's Environmental Challenges and Constraints

London also faces other pressures, such as the projected impacts of climate change on the city[8] and its economy[9], and the need for the city to remain competitive in an increasingly global economy. It also has to deal with some existing environmental challenges such as the failure of London's rivers to meet river water quality standards and limits on air pollutants *(see box below)*. Well-planned and managed green infrastructure can help London meet these challenges.

London's Environment – Challenges and Constraints

Population Growth

Over 8.6 million people currently live in London. The population continues to grow, with population projections for 2041 being an unprecedented 10 to 11 million, and still rising. It is estimated that London will require around a million more homes, and places for over 850,000 additional jobs. The additional buildings and activities will increase demand for land, water and energy, which could have significant environmental impacts if not planned and managed properly.

Climate Change

London is potentially more at risk from climate impacts than other parts of the UK because of its complexity, density and location. It also has a high concentration of vulnerable groups, which are likely to be disproportionately affected by the impacts of climate change. The UK Climate Projections 2009 (UKCP09), produced by the Met Office on behalf of Defra, identified the following (medium scenario) climate change impacts for London:

- Average summer temperatures will increase by 1.5°C by 2020, rising to 2.7°C by 2050, but the temperature on the hottest day of the year will increase by up to 10°C.
- Summer rainfall will decrease by 6% by 2020 and 18% by 2050, but with the possibility of storms of increased intensity.
- Winter rainfall will increase 6% by 2020 and 15% by 2050.

These projected changes increase the potential for flooding and the adverse effects of the urban heat island effect.

Flooding

Almost a fifth of London is in the Thames floodplain. Most of this area is very well defended by traditional hard-engineered flood defences. However, the upstream part of the Thames and many of the tributaries to the Thames have lower standards of protection. Traditional flood defences can only protect London from predictable fluvial and tidal flood risk. However, the city is also vulnerable to surface water and sewer flooding from storm and heavy rainfall events. This is due to increasing areas of impermeable surfacing (such as roads, roofs and pavements) and the legacy of a Victorian drainage system that wasn't designed to cope with demands of a city of more than 10 million people.

Heat

The urban heat island effect is a well-known phenomenon in modern cities. The built environment is comprised of materials that are very effective at storing heat, which is released more slowly than it is absorbed. This results in a build-up of heat in densely developed parts of the city, which can be exacerbated by waste heat generated by energy use. During periods of prolonged high summer temperatures the urban heat island effect can develop to such an extent that it makes some parts of the city uncomfortable places to live and work. In extreme events, the urban heat island effect can result in excess deaths, particularly amongst the old and infirm.

Air Quality

The National Air Quality Regulations set legal limits for nine pollutants that affect human health. London is meeting limits for eight of these pollutants. However, there are two that remain a concern. These are particulate matter (PM_{10} and $PM_{2.5}$) and nitrogen dioxide (NO_2). Although London is meeting the limits for particulate matter, this pollutant is damaging to health at any level, and so more needs to be done to reduce this. London, along with a large number of other cities, is failing to meet the legal limit for NO_2.

River Water Quality

The Water Framework Directive[10] (WFD) aims for 'good status' for all rivers (and other water bodies) measured in terms of their chemical, biological and physical condition and quality. Of the river water bodies in London, two are 'bad', eight are 'poor' and the rest are 'moderate'. The primary reasons for the failure of London's rivers to meet WFD standards are: diffuse pollution from road run-off, foul water misconnections to the surface water drainage system, and point source pollution from treatment works. The physical modification of many of London's rivers by culverting, canalisation, etc. also contributes to the failure to meet 'potential good' status under the WFD framework.

Water Supply

London's per capita water demand is higher than most other UK regions. Population growth will increase demand even with efficiency gains– there is a projected 10% shortfall of supply against demand as soon as 2025, growing to 21% by 2040. London is already extracting a large percentage of the available water from its surrounding rivers and groundwater, with resulting environmental impacts.

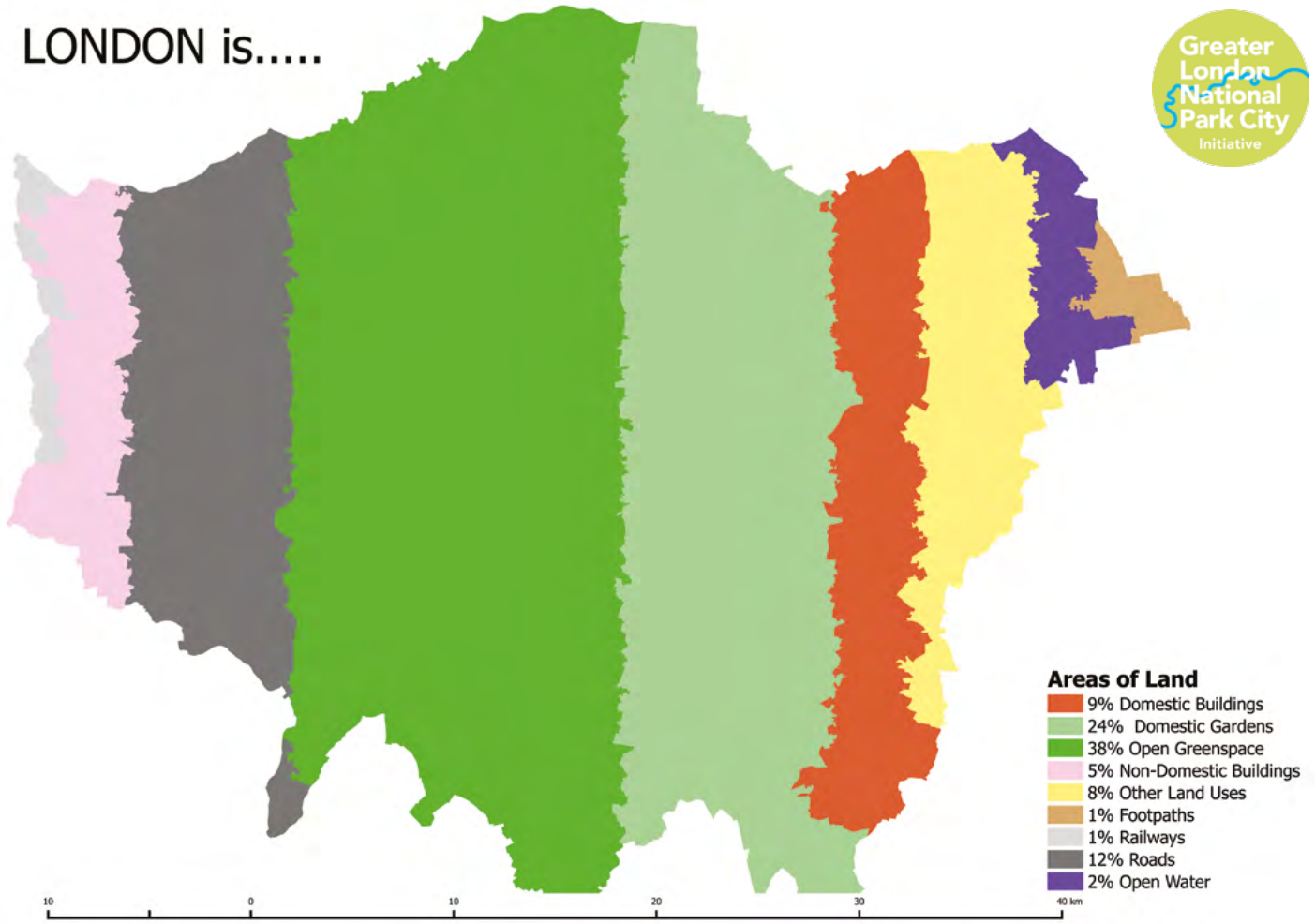
The Barriers to Implementing a Green Infrastructure Approach

Delivering a green infrastructure that can address the socio-economic and environmental imperatives of the coming decades is not simply a matter of maintaining and improving the use and aesthetics of London's existing green infrastructure, which are extensive *(see Figure 1)*. It is about realising the true potential of these assets by maximising the benefits that they can provide. To do this, we need to rethink the way we plan, design, manage and fund the city's green infrastructure, without compromising their intrinsic worth.

However, there are barriers to making this happen. For example, there is only a limited understanding of the role, value and potential of green infrastructure amongst many stakeholders, resulting in much of it being under-utilised and underfunded. In addition, there is a complex array of management arrangements and funding mechanisms that results in an often inefficient and ineffective approach to investment. We also do not yet routinely consider the relationship between the different elements of green infrastructure (from parks to green roofs and from street trees to woodlands) to ensure that they have connected and complementary functions.

We develop these issues in further detail in the following chapters of the report, which consider:
– Defining functions
– Revealing economic benefits
– Securing efficient delivery
– Identifying new sources of finance.

Figure 1: Land Cover in London



N.B. The actual area of land in London which is green is 47%. This is because 14% of domestic garden land is paved, decked or occupied by out-buildings. Similarly up to 5% of land in parks is occupied by hard-surfaces.

Furthermore, there over 8 million trees in London, covering approximately 20% of London's surface. Most of these are in woodlands, parks and gardens. There has been a significant increase in the installation of green roofs and other green infrastructure integrated into the built environment in recent years. An assessment undertaken by the Greater London Authority estimated that there are now at least 17.5ha of green roofs in central London alone[11].

Section Footnotes

[1] http://www.gardenvisit.com/landscape_architecture/london_landscape_architecture/landscape_planning_pos_public_open_space/1943-44_abercrombie_plan Back to page

[2] http://www.london.gov.uk/what-we-do/planning/london-plan/current-london-plan Back to page

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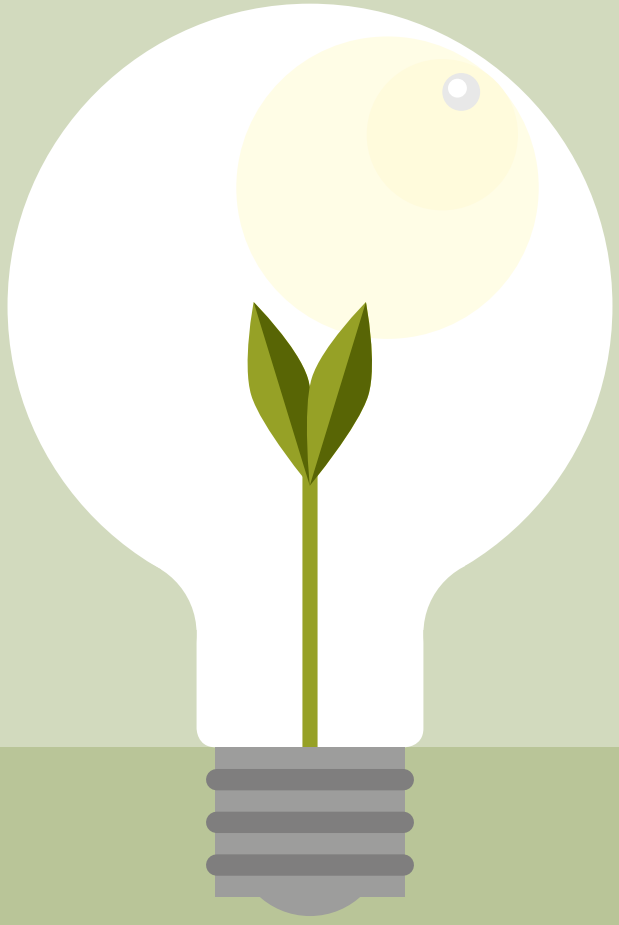
Section One:

Rethink Purpose



Defining Green Infrastructure Functions in the Future City

Green infrastructure has often been seen as a counterpoint to the city, rather than as an integral part of the urban environment upon which the prosperity and viability of the city depends. Partly because of this, the provision of green infrastructure has primarily been determined by spatial considerations. For example, the amount of green space required per person to provide for amenity and recreation, and by the need to protect and conserve special landscapes and natural assets. This approach was underpinned by previous guidance issued by the Mayor and CABESpace in the form of the *Open Space Strategies Best Practice Guidance*[12]. Consequently, the potential functions and services that green infrastructure can provide have been largely under-appreciated and unrealised.

But the environmental and social challenges posed by a growing city require a refined set of objectives for London's green infrastructure. These should justify the investment needed to tackle the most pressing issues for Londoners in the future; embrace the original reasons for protecting and managing open space; and also identify the functions that:

– are likely to be more relevant for the city in the future;
– relate to wider geographies than the administrative boundaries of local authorities;
– are more resonant with the attitudes and aspirations of growing urban population;
– are applicable also to the greening of the built environment and public realm, and;
– contribute to the idea of a liveable city.

Footnotes for this section are on page 25

Why is Rethinking Necessary?

Natural England, the Government agency, describes green infrastructure as a multifunctional network of green space[13]; the United States Environmental Protection Agency views green infrastructure through the lens of stormwater management[14]; and the advocates of green roofs and street trees regard green infrastructure primarily as the greening of the built environment and public realm. None of these are satisfactory when describing the future potential of green infrastructure in London as they are either too generic, focused on one purpose, or relate to form rather than function.

We therefore need to rethink the roles and configuration of our urban green spaces, just as we regularly upgrade or modify other forms of infrastructure. We also need to consider how to fill the gaps in our green infrastructure, by incorporating it into buildings (for example, as green roofs and walls) and streets and public realm (for example, as rain gardens and swales) in ways that provide benefits, such as sustainable drainage and urban cooling. Individual spaces, and the network as a whole, must be designed and managed to address current and future challenges, rather than simply reflect historic design and use.

Much of London's green infrastructure (other than domestic gardens, agricultural land, private sports pitches and golf-courses, etc.) is managed and funded by the public sector. However, most public bodies and local authorities have no statutory obligation for its provision or maintenance. As a result, green infrastructure often suffers most from budget tightening during periods of austerity.

To make a more compelling case for long-term investment, it is necessary to identify how the benefits of green infrastructure can contribute towards the statutory obligations of the public sector and growing the city economy. There is also a need to demonstrate to private sector stakeholders (for example, utility companies and companies involved in regeneration), that green infrastructure can provide benefits that complement their land management or development objectives.

There are considerable opportunities for improving the city's green infrastructure in those areas that are programmed for major urban regeneration and renewal. This has already been demonstrated with the creation of the Queen Elizabeth Olympic Park *(see Case Study 1)* and the subsequent Olympic Park legacy programme[15]. The principles of this approach can be replicated in the regeneration and renewal of London's Opportunity Areas[16] *(see Box on next page)*.

Case Study 1:
No Ordinary Park – Green Infrastructure and the Queen Elizabeth Olympic Park

The design for the Queen Elizabeth Olympic Park aimed to deliver a functional, rich, productive and beautiful urban landscape that could successfully transition from supporting the Games to becoming an integral piece of green infrastructure[17], contributing to a sustainable and thriving new neighbourhood.

The functionality of the landscape has been enhanced through the creation of an extensive sustainable drainage network designed to ensure better flood-risk management, water storage and cleansing. This network of green roofs, swales, detention basins and 800m of river broken out of concrete banks has also formed the basis for the ecological enhancement of the park, along with the now celebrated wild-flower meadows.

For decades, this part of the Lee Valley had suffered from very poor connectivity, particularly between communities to the east and west of the strategic north-south route of the wider Lee Valley Regional Park. The park has provided a significant number of new connections to ensure easy, safe access to and from new and existing residential areas and transport hubs.

Olympic Park development site (November 2008).
© London Legacy Development Corporation

Queen Elizabeth Olympic Park (July 2015).
© London Legacy Development Corporation

Green Infrastructure and London's Growth

Opportunity Areas are London's major source of land, with significant capacity for new housing, commercial and other development. They are dependant on existing or future improvements to public transport, along with other supporting facilities and infrastructure.

Old Oak and Park Royal Development Corporation (OPDC)

The Old Oak Common and Park Royal Opportunity Area covers over 650ha of industrial and railway land in West London and is the location for a new railway station connecting High Speed 2 (HS2) to Crossrail.

A Development Corporation has been created to transform the site into a major transport interchange, and to deliver housing and commercial development, surrounded by sustainable neighbourhoods[18]. A new approach to delivering green infrastructure has been identified as essential to deliver sustainable regeneration, and the OPDC has committed to preparing a Green Infrastructure Strategy that will:

– Provide new green infrastructure to enhance connections between spaces.
– Use green infrastructure to sustainably manage rainwater.
– Improve ecological connectivity by enhancing green corridors.
– Provide soft landscaping such as street trees, green roofs and walls around and on buildings to provide shading and evaporative cooling.

As space in urban environments becomes more precious, planning for green infrastructure needs to be considered using a multilayered approach to ensure effective urban greening.

New Green Infrastructure Objectives

Building on the existing policy framework of the London Plan, and addressing the issues identified in the London Infrastructure Plan 2050, we propose that the purpose of green infrastructure in a future city can be defined better by the following strategic objectives:

1. **Promoting Healthy Living** – improving health outcomes by increasing physical activity, reducing stress and removing pollutants.
2. **Strengthening Resilient Living** – keeping the city cool, its air clean, and protecting it from flooding.
3. **Encouraging Active Living** – increasing levels of walking and cycling.
4. **Creating Living Landscapes** – enhancing natural processes for the benefit of people and wildlife and conserving the most special landscapes, habitats and species.
5. **Enhancing Living Space** – providing a range of outdoor space for cultural, civic, learning and community activity, including productive landscapes.

Establishing goals and performance indicators against which delivery of these objectives can be measured is also vital to determine the cost-effectiveness of green infrastructure. The proposed ambitions set out below provide a starting point from which to develop a comprehensive suite of indicators that can be measured against good quality data.

Proposed Green Infrastructure Ambitions by 2050:

– London should maintain its status as one of the world's greenest capital cities – 50% of the administrative area should be green infrastructure. This would require an increase in green cover of approximately 9000ha – the area currently covered by London's front gardens.
– London should maintain its "urban forest" by increasing tree cover from 20% to 30% of London's area – 1 tree for every Londoner.
– 80% (9 million) of Londoners will be walking, jogging or cycling at least 2 miles per day.
– Surface water flows into the sewer network will be reduced by at least 25% (the draft London Sustainable Drainage Action Plan aims to achieve this by 2040).
– EU standards on water quality will be met for all of London's rivers.
– At least 20% of London's area will be designated of high wildlife value.

Our suggested five strategic objectives (which are described in further detail in the following pages) and the need for better indicators of performance provide the basis for our first five recommendations on the next page.

'The potential benefits that green infrastructure can provide have been largely under-appreciated and unrealised. Green infrastructure is an urban infrastructure hidden in plain sight.'

Recommendation 1
The Mayor should ensure that green infrastructure, based on the definition provided by our vision, is a key theme in the preparation of the London Environment Strategy[19], and relevant policies are updated in the London Plan review.

Recommendation 2
The Mayor should ensure that there is a robust evidence base on which our proposed five strategic objectives can be measured and monitored.

Recommendation 3
The Mayor should develop more definitive standards for green infrastructure, related to our proposed five strategic objectives, in the next iteration of the London Plan.

Recommendation 4
The Mayor should update the All London Green Grid Supplementary Planning Guidance, and replace the outdated Open Space Strategies Best Practice Guidance with guidance on green infrastructure strategies.

Recommendation 5
The Old Oak and Park Royal Development Corporation should produce a green infrastructure plan based on our proposed five strategic objectives. The London Infrastructure Delivery Board should ensure that this approach is applied in other Opportunity Areas.

1. Promoting Healthy Living

There is significant and growing evidence of the public health benefits of access to good quality green spaces[20]. These include: better self-rated health; lower body mass index, overweight and obesity levels; improved mental health and wellbeing; and increased longevity; all of which are health issues that need to be improved in London *(see Box above right)*.

London's Health Challenges

- In comparison to other world cities London's child and adult obesity rates are high.
- London's air quality is 50% worse than the national average resulting in a higher rate of deaths attributed to air pollution.
- The percentage of Londoners using outdoor space for exercise or health reasons is lower than the national average.
- The health issues outlined above are disproportionately affecting lower income households.

Source: Public Health England

The Natural Solutions to Tackling Health Inequalities (2014)[21] report demonstrates that better health is related to access to green space, regardless of socioeconomic status. However, it also highlights current inequalities in the use of, and access to, natural environments across England. Arguably, the existing parks and green spaces have always provided a health function, simply by providing a space for recreation and relaxation. This was recognised by the London Health Commission[22] in their 2014 report[23] *(see Box below)*.

Healthy Leisure

"London could also do more to harness the benefits of its unusually large amount of green space by using them as a natural rallying point – as already happens informally and at a more local level – for healthy activity. Londoners naturally gravitate to their parks for physical activity and sports. Collectively, the prize of these initiatives would be more than just lost weight and a slimmer city. The Commission strongly supports the Mayor's cycle superhighways scheme, encouraging Londoners to travel around the city actively for work or leisure, improving health, and without the harmful emissions associated with other forms of transport."

Better Health for London, London Health Commission (2014)

However, this has largely been a benefit provided by default rather than by design and there are no requirements for green infrastructure to optimise physical or mental health, other than those linked to quality standards such as the Green Flag Award[24] (although these relate mainly to safety, security and cleanliness). Instead, the primary role of much existing green infrastructure is to provide an outdoor setting for physical activity, such as organised sports or outdoors gyms, or other recreational pursuits, such as dog-walking.

There has been some progress in linking green infrastructure with health through, for example, green prescribing[25]. This is where doctors prescribe outdoor physical activity, as part of the patient's health management. Advances in technology and mobile communications also

provide opportunities for encouraging behaviour change to more healthy activities and lifestyles *(see Box below)*.

Sensing London

Future Cities Catapult[26], in collaboration with Intel Collaborative Research Institute, and The Royal Parks, established a 'Living Lab'[27] in Hyde Park to measure environmental variables using new, prototype technologies. The objective was to collect and use real city data, including air quality and human activity, to understand how people use green spaces and to assess the impact that cities have on human health, wellbeing and the natural environment. An additional goal was to use data from the demonstrator to instigate some behaviour change through applications and services.

The aim is to develop new solutions to problems and issues identified that could include anything from apps that tell asthmatics how to navigate the city with minimum exposure to air pollution, to providing evidence to justify investment in green infrastructure to improve human health in the long-term.

Recommendation 6

The Mayor and Public Health England should develop a pilot project to robustly test the ability of targeted green infrastructure improvements to deliver specific health outcomes and create savings for health budgets.

Currently, the primary measure of green infrastructure's potential for providing health benefits is people's proximity to it. There have been many studies correlating proximity to green space with physical and mental health, and there have been some attempts to take into account factors such as socio-economic status. However, we do not yet fully understand the impact that green infrastructure has on health. For example, does the creation of green corridors encourage more regular cycling and walking and therefore deliver better health for people less likely to undertake more formal exercise regimes? Are the mental health benefits of green infrastructure best delivered by greening of streets and the public realm, or by provision of better quality parks?

To ensure that public health can become a major justification for investment in green infrastructure, the design and management of green infrastructure must be able to demonstrate the delivery of specific health outcomes for key groups. Health and Well-being Boards[28], established relatively recently at the borough level to deliver improvements to health and reduce health inequalities, could have a significant role play in this respect. However, for these Boards to invest in green infrastructure projects, they will require a clear return on investment case to be made, with explicit demonstration of the health outcomes that would be delivered.

2. Strengthening Resilient Living

It is widely accepted that the effects of climate change could have significant impacts on London because it is difficult to adapt the existing built environment to deal with increased flooding and warming[29]. However, the European Union funded project GRaBS (Green and Blue Space Adaptation for Urban Areas)[30] has demonstrated that cities with extensive, well designed and planned green infrastructure, and with policies in place to green the exterior of buildings, are more likely to be able to adapt and become more resilient to the impacts of climate change.

Managing Flood Risk

Green infrastructure interventions are widely recognised as playing an important role in reducing the risk of flooding by absorbing, storing or dispersing floodwater. River restoration in various London parks, initiated following the publication of the *London Rivers Action Plan* (2009)[31] have created opportunities for upstream flood storage; whilst sustainable urban drainage projects such as rain gardens and green roofs can slow down the discharge of rainwater run-off into the drain and sewer network. These approaches and others are detailed in the draft London Sustainable Drainage Action Plan[32].

SuDS and Green Infrastructure – Understanding the Opportunity

The GLA is working with Thames Water and the Environment Agency to develop a more quantitative approach to understanding the potential role of green infrastructure and sustainable drainage systems (SuDS) in managing this risk. The work involves three key stages:

1. Modelling the capacity of the sewer and drainage network to deal with a 1 in 2 year rainfall event for each of the eight sewer catchments in London.
2. Modelling where and how much SuDS can be retrofitted to absorb rainfall.
3. A new cost-benefit analysis to understand the value of a cubic metre of rainwater not in the sewer (or causing flooding) and monetising the benefits of green vs grey infrastructure.

The above work will demonstrate how much water we need to remove to manage flood risk; the amount of green infrastructure based SuDS needed to help to manage this; where it is easiest and most effective to do it; and, inform a new framework to support investment.

The Drain London programme[33] was created in response to the Mayor's Regional Flood Risk Appraisal, which identified surface water flood risk as the most likely cause of flooding in London. Through the programme, flood risk modelling has been undertaken to help London boroughs to better understand the risks in their borough and to

identify potential solutions. The next step is to determine which interventions are likely to be most effective and deliverable *(see Box on previous page)*.

Despite an increasing number of good examples of these types of interventions[34] *(see Case Study 2)*, implementation is currently rather piecemeal. This is because of a number of factors, including: the limited number of opportunities for delivering large scale projects due to conflicting land-uses; the complexity of determining the most effective interventions at a catchment or neighbourhood scale, and; the current over-reliance on schemes implemented by developers that may not deliver the most strategically important interventions. However, through the auspices of the Drain London partnership, the Environment Agency, civic society organisations such as Thames 21[35], and Thames Water are developing more collaborative approaches and programmes[36], including Thames Water's 'Twenty4Twenty' programme, which aims to disconnect 20ha of urban realm from the piped surface water drainage network by 2020.

Recommendation 7

The Mayor should work with Thames Water to maximise the opportunity for delivery of green infrastructure based SuDS through Thames Water's 'Twenty4Twenty' and successor programmes. (N.B. See also Recommendation 23).

Keeping Cool

City parks, particularly those with significant tree cover and/or large water-bodies, have always played an important role as places to seek respite from high summer temperatures, and large canopied street trees can significantly reduce temperatures at street level by providing shade. However, the urban heat island is a cumulative effect resulting in the build- up of ambient temperatures in city centres and high-density neighbourhoods. Mitigating its impact therefore requires minimising the capacity of the built environment to store and re-radiate heat.

Green infrastructure can make a significant contribution to urban cooling, lowering local ambient air temperatures by 2°C to 8°C[37]. This is the reasoning behind the inclusion of an Urban Greening policy (Policy 5.10) in the current London Plan. Increasing canopy cover and the extent of green roofs in the urban environment reduces the amount of solar radiation absorbed by artificial materials and cools the air through the process of evapotranspiration (the movement of water within a plant from the soil to the air). These benefits can be maximised by considering the spatial layout of green infrastructure such that 'cool corridors' and 'breeze pathways' are created through the urban environment. These could be associated with greener walking and cycling routes designed to promote active travel. They can also help to make streets more attractive to use, leading to increased dwell time and economic activity.

Case Study 2:
Firs Farm Wetlands – Storing Water and Improving Water Quality

Firs Farm Wetlands is a project to create new functional wetland in part of an under-utilised park in Enfield.

Funded by Enfield Council, Thames Water, the Environment Agency and the Mayor of London, it will create 4,000m^2 of new wetland habitat that will improve water quality, and store 30,000m^3 of water, reducing the risk of flooding for parts of the A10 and more than 100 residential properties. The project will also enhance 2.4 ha of habitats, including the restoration of 500m of a culverted watercourse (a 'lost' tributary of Pymmes Brook). A new footway and cycle route providing a safer route to the nearby school will also be created.

Firs Farm Wetlands visualisation. © London Borough of Enfield

Recommendation 8

The Mayor should ensure the target to increase green cover in the Central Activities Zone (set out in Policy 5.10 of the current London Plan) is extended to all areas of the city where higher density development is planned, such as Opportunity Areas.

3. Encouraging Active Living

Around 12% of London's surface area consists of roads and streets and these amount to almost 80% of the public realm in the most densely developed parts of London. As the city grows there is a need to constantly rethink their use and function to ensure that the space they occupy helps deliver economic, social and environmental outcomes. In most situations this means improving how people and vehicles move; but in other places it is about rethinking how space is allocated to different uses as demands and expectations change.

The Roads Task Force[38] was established by the Mayor to explore these issues. One of the key recommendations of the Roads Task Force report[39] was the establishment

of a 'street family' of nine Street Types, in which streets are defined by the significance of their 'movement' and the intensity of their 'place' *(see Figure 2)*. Those street types where traffic speeds should be below 20mph and where pedestrians and people have priority are those with most potential to be to re-imagined as public realm which is greener, safer and more user-friendly.

Figure 2: Proposed Street Types

Walking and cycling more results in better physical health[40], and is the main way that most Londoners get their physical activity. Consequently, making streets more welcoming environments for walking and cycling provides the biggest potential for increasing physical activity. The range of health benefits are set out in *Improving the Health of Londoners*[41], Transport for London's health action plan, which introduces the concept of 'Healthy Streets'.

As the city grows, the public realm function of roads and streets needs to be recalibrated, undertaken in Green infrastructure can add value to and accelerate this change, deliver complementary services, such as sustainable drainage *(see Case Studies 3 and 5)*. Recent research has also highlighted that the overall density of street trees is associated with higher rates of walking, and that the connectivity and greenness of the street network is positively associated with distance walked[42].

This recalibration requires not only the greening of streets but also the consideration of how cycling and walking through-routes (rather than internalised recreational routes) can be accommodated in existing parks, or designed as a key function as new green spaces. The ambition should be to create 'active travel' corridors where preferred routes to school, high streets or places of work are direct and destination orientated, rather than simply recreational, and are designed to incorporate sustainable drainage and other benefits of green infrastructure.

Recommendation 9
The Mayor should work with Transport for London to ensure green infrastructure is integrated into its future cycling and walking strategies, and related design guides.

Case Study 3:
Garibaldi Street – Re-imagining a Street as Green Infrastructure

Garibaldi Street is a major arterial road running through Lyon in France. Designed as an "urban motorway" in the 1960s, the oversized road no longer serves contemporary needs for development and quality of space. Re-engineering has turned the six-lane road into a people-friendly green street. The 2.6km project drastically re-allocates space between highway users to favour pedestrians, cyclists and buses. The scheme features extensive tree planting, designed to provide shade and manage surface water runoff from the footways and cycle paths. Structural growing medium is being used underneath footways and cycle paths to maximise the rooting volume allowing the roots of trees to access the open soil provided in nearby linear landscape verges collecting rainwater.

Further information: *Trees in Hard Landscapes* (TDAG, 2014)[43]

Garibaldi Street, Lyon. © Sophie Barthelet

4. Creating Living Landscapes

The protection of the natural environment and the conservation of biodiversity has long been an important principle of land-use planning policy in London. This is, in part, because of strong cultural associations with nature and landscape, and a firmly embedded legal framework protecting special sites and key species. There is also a growing body of evidence that 'access to nature' is an important aspect of the widely accepted health benefits of green infrastructure – especially in relation to mental health[44].

Nevertheless, there is an inevitable tension in the idea of protecting nature in the context of a growing city. Although protecting special sites from development or inappropriate uses should remain a core objective of city planning, there is a need for additional approaches that engage a larger number of people and are more consistent with the concept of green infrastructure. It will involve increasing the ecological resilience and improving the ecological

connectivity of the existing green network in order to conserve wildlife and natural habitats in ways that can also be beneficial for people.

This is being explored through the concept of Living Landscapes[45] *(see Box below)*. This focuses as much on the restoration of ecological function for the benefit of people as it does on nature conservation. It serves to better integrate ecological and social needs, on the basis that improved ecological function contributes to improved air and water quality, the provision of space for growing food, and the creation of landscapes that proactively (rather than passively) contribute to well-being. It takes forward the principles set out in *Making Space for Nature*[46] – a Government-commissioned independent review of England's wildlife sites and ecological networks – which are as applicable in the city as in the wider countryside.

Living Landscapes
Reconnecting London's highly fragmented landscape is a huge challenge. The Living Landscapes principle is based on the rationale of linking and enhancing greenspaces at a landscape scale to help restore damaged ecosystems and protect healthy ones. A landscape with strong connectivity is more likely to deliver ecosystem services, such as better air quality, temperature amelioration and flood alleviation, and wildlife-rich sites are likely to be more resilient.

The Great North Wood Project
The Great North Wood was a large tract of woodland and wooded commons that covered the high ground between Deptford and Selhurst. It was managed for timber, charcoal, tannin and firewood. However, the Industrial Revolution and the enclosure acts from the late 18th century led to the Great North Wood losing its economic importance, and it being partitioned and sold for development. Today it consists of 20 remnant woodlands and a mosaic of parks and green space, linked by gardens and street trees.

The Living Landscape project[47] will reconnect and enhance these remnants to restore a wider woodland ecology that will improve habitats for wildlife but also create green walking and cycling routes and encourage tree planting outside of the core areas to deliver the climate change and air quality benefits of an expanded urban forest.

Great North Wood. © Craig Harrison

The principles of Living Landscapes are also applied in the Catchment Based Approach,[48] which has been developed to encourage a more collaborative approach to working at river catchment scale. Catchment partnerships in London[49] have been established to promote this way of working within London and across its administrative boundary. Furthermore, London boroughs are beginning to develop specific policy guidance to promote restoration of rivers and their catchment function, Lewisham's *River Corridor Improvement Plan*[50] being a good example.

However, these ideas are not widely understood and appreciated by a population with an increasingly urban mind-set. Therefore, a public engagement and awareness campaign is needed to reconnect people with nature and the benefits it provides.

Recommendation 10
The Mayor should work with the National Park City initiative and other stakeholders to develop a public-facing campaign to raise awareness of the benefits of green infrastructure.

5. Enhancing Living Spaces

Green space as an amenity that provides space for recreation and outdoor sport, and as a setting for cultural and civic activity, has been the basic purpose of much of the existing green infrastructure resource to date. This should remain the case.

However, the amenity of existing green infrastructure is highly variable both in terms of quality and spatial provision. Traditional parks are often more extensive and of better quality in more affluent parts of the city, but even these do not always provide an amenity function for those (the old, the infirm, some ethnic minorities and, increasingly, children and young people) who are unable or unwilling to access or use traditional parks. Often, unless they are in very close proximity, they are spaces that are visited for a particular purpose or activity rather than being places that are used and experienced on a daily basis. This irregular use of traditional green spaces reduces their capacity to provide health and amenity benefits, and limits their role as civic space where people and cultures mix and build communities.

Furthermore, there are significant areas of London that have insufficient access to green space or access to nature based on the current London Plan standards *(see Figure 3)*.

With the increasing need to densify parts of the city, there are unlikely to be opportunities for creating extensive new areas of traditional parks and green spaces in these locations. As a result, more innovative solutions are needed, such as roof gardens or the greening of buildings, streets and the wider public realm. Using a green infrastructure approach to planning and designing for amenity, this could include:
– Blurring the borders so that the formal boundary of

a traditional park (the archetypal park railings) doesn't define an absolute and definitive transition between urban public realm and green space. This ensures that the environmental and social amenity provided by the green space permeates into the wider public realm.
– Creating publicly accessible green roofs and roof gardens in those parts of the city that will become denser in the future.
– Making the most use of incidental green space and underused parts of the public realm, by establishing rain gardens, urban orchards, pockets parks, etc.

The regeneration of the Woodberry Down Estate[51] showcases some of these approaches *(see Case Study 4)*.

Cities such as Malmö in Sweden and Berlin in Germany have pioneered new approaches to increasing green cover through their respective Green Space Factor[53] and Biotope Area Factor polices *(see Box on next page)*.

Malmö – Green Space Factor

The Green Space Factor used in new developments in Malmö, such as Augustenborg and Western Harbour. It is a tool that can be used to measure the ecologically effective land area of a development.

The ecologically effective area is defined as the area of a development that contributes to ecosystem function through, for example, stormwater drainage or habitat provision. Surfaces such as grass, gravel, vegetation, and green roofs are given a score based on how much they contribute to ecosystem function. For example, a surface of concrete or asphalt would get a score of 0.0 while a green roof would get a score of 0.7 and a surface covered with vegetation would get the highest score of 1.0. This rating is then multiplied by the total area that the feature covers of the development. Adding up all of these scores gives you the ecologically effective area. This ecologically effective area is then divided by the total area of the development to give you a final green space score that is used to calculate the green space requirements for new development.

Recommendation 11

The Mayor should develop a version of the Green Space Factor as a means to address deficiencies in access to open space and access to nature in the most densely developed parts of the city.

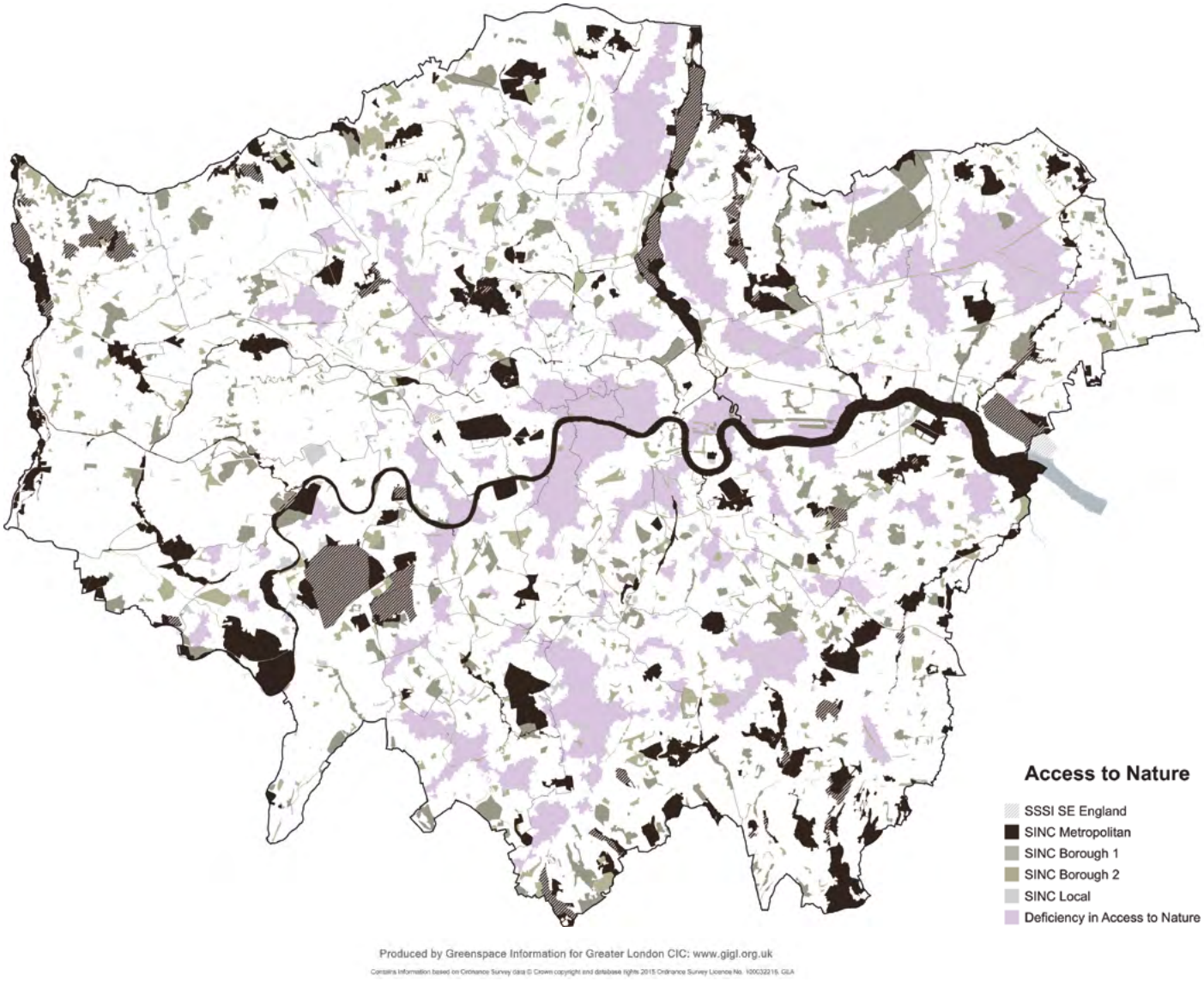
Case Study 4:
Woodberry Wetlands – Greening Development and Increasing Access to Nature

Stoke Newington reservoirs in North London have been an important landscape feature for well over a hundred years, but have been inaccessible to the public due to reasons of health and safety and the protection of an important water supply. However, the redundancy of the reservoirs for water supply and the redevelopment of the neighbouring Woodberry Down estate provided an opportunity to create a new, accessible nature reserve and green space that has also informed the greening of the newly developed Woodberry Down. The result is the blurring of the boundaries between public and private realm with green infrastructure that includes sustainable drainage, new footways and cycle routes, green roofs and an enhanced ecology[52].

Woodberry Down Regeneration and Woodberry Wetlands.
© Berkeley Group

Figure 3: Deficiencies in Access to Nature

N.B. This deficiencies in access to nature map shows localities that are more than one kilometre's walking distance from a publicly accessible Site of Borough or Metropolitan Importance for Nature Conservation.



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[12] https://www.designcouncil.org.uk/sites/default/files/asset/document/open-space-strategies.pdf Back to page

[13] http://webarchive.nationalarchives.gov.uk/20140605090108/http:/www.naturalengland.org.uk/ourwork/planningdevelopment/greeninfrastructure/default.aspx Back to page

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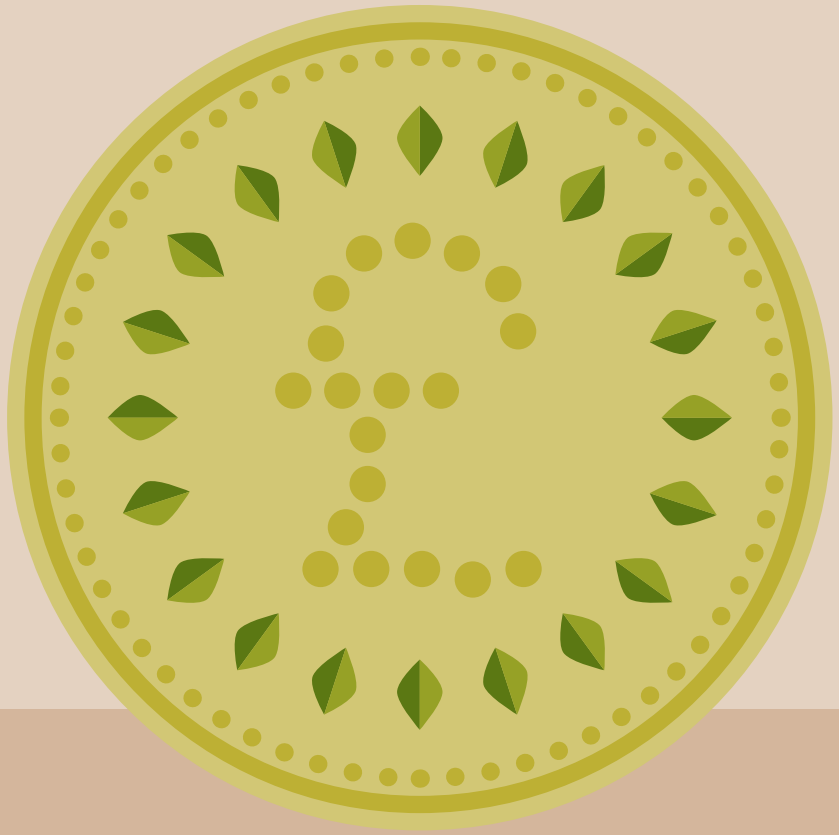
Section Two:

Reframe Value



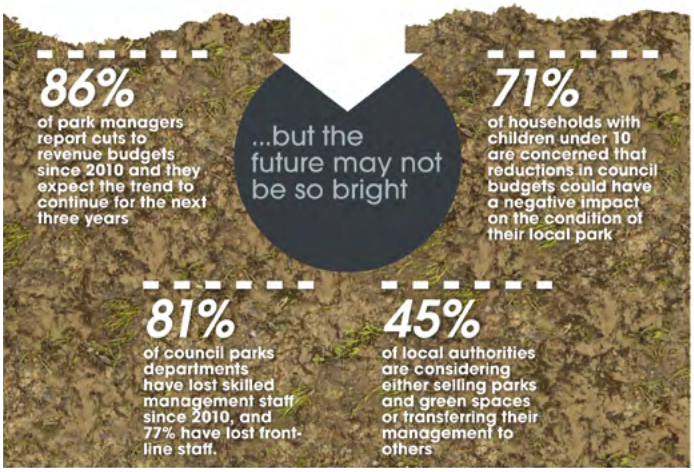
Revealing Economic Benefits of Green Infrastructure in the Future City

One of the key barriers preventing sustainable investment in green infrastructure is the difficulty in identifying its economic value to make a compelling business case for investment. When framed as parks and green spaces that are simply public goods, the value of the assets to the land-owner, and to local communities, are not properly understood and appreciated and so are too easily ignored. This results in low levels of investment that are often *ad hoc* or intermittent.

Footnotes for this section are on page 31

This cycle of boom and bust in parks funding has been highlighted on several occasions, most recently in the State of UK Public Parks (2014) report[54] by the Heritage Lottery Fund (see *Figure 4*).

Figure 4: The 'Boom and Bust' Cycle of Parks Funding



Why Don't We Value Green Infrastructure?

We don't plan and design existing parks and green spaces as an integrated green infrastructure. Perhaps because of this, they are often perceived simply as either a 'nice-to-have' accessory or, in the case of green roofs or street trees provided by developers, as an extra cost imposed by planning regulation. Consequently, descriptions of their value are usually based around social or environmental outcomes that are rarely described or assessed in monetary terms. This is unlike other urban infrastructures, supply commodities or services that can be priced and traded to some degree.

Furthermore, green infrastructure also differs from other infrastructure in that there are rarely obvious primary revenue streams (fares, bills, etc.) relating to the provision of the service that cover or offset the cost of managing, maintaining and upgrading the infrastructure.

These two issues of an unseen value and lack of a revenue-raising mechanism present a fundamental challenge to securing long-term investment in green infrastructure – an economic problem that is summarised by Professor Dieter Helm, former Chair of the Government appointed Natural Capital Committee[55], in *The Economics of Natural Capital*[56] *(see Box below).*

Pricing the Environment?

"The reason to attribute an economic value to green infrastructure is not so a 'price' can be put on it enabling it to be sold off or commoditised. Valuing the services and benefits provided by green infrastructure is necessary so that these are properly accounted for when deciding, for example, how to enhance resilience or improve public health. The tendency to ignore this value has been a major problem in the past and has too often resulted in under-investment in and inadequate management of the city's green infrastructure, resulting in a cumulative deficit which threatens the capacity of the city's green infrastructure to contribute to our long term resilience and well-being.

The work of the Natural Capital Committee has shown that there is a very good economic case for investing in the services provided by natural capital and green infrastructure. But to strengthen the argument it is necessary to identify the value of the services and benefits provided by green infrastructure in ways which are comparable to the methodologies used to inform investment decisions for other forms of infrastructure where monetary valuation is a routine part of the process."

From *The Economics of Natural Capital* (Chatham House, 2015)

This inability to properly value the benefits of green infrastructure and undertake effective cost/benefit analysis hinders the ability of key bodies such as the London Infrastructure Delivery Board[57] and London Enterprise Panel (LEP)[58] to encourage and support appropriate investment *(see Box below).*

Supporting Regeneration, Jobs and Growth – What Role for Green Infrastructure?

The London Infrastructure Delivery Board

The Mayor has established the London Infrastructure Delivery Board to take the lead in improving delivery of London's infrastructure. The aim is to achieve more efficient, integrated and innovative infrastructure solutions to ensure London remains the greatest city on earth.

Working with the Mayor's Design Advisory Group, it aims to demystify what good growth really means for Londoners to get the public's perspective on growth (what makes growth popular or unpopular), and to showcase what good growth looks and feels like.

The London Enterprise Panel

The LEP is the body through which the Mayor works with London's boroughs, business and Transport for London to take a strategic view of the regeneration, employment and skills agenda for London, and to be a critical client of all the public and private sector organisations that deliver and regulate London's infrastructure.

In its *Jobs and Growth Plan for London*[59] the LEP recognises that supporting investment in infrastructure is one of its four strategic priorities. It has a role in encouraging infrastructure investment into London to keep the city moving and functioning and the LEP itself can provide funding to support infrastructure projects and to promote globally London's expertise in delivering infrastructure projects. It can use its limited but not insignificant resources to lever in additional funds and commission research.

How Can We Solve This Problem?

In an attempt to address this fundamental problem of not properly valuing the services and benefits of green infrastructure, the last Government established the Natural Capital Committee (NCC)[60]. [N.B. the original NCC completed its initial work in September 2015. The current Government has committed to re-establishing the committee to take forward the 'natural capital' agenda].

The initial role of the NCC was to:

- advise on how to better integrate the value of natural capital (green infrastructure) into decision making at all levels;
- create and trial experimental accounting frameworks that organisations can use to value natural capital they own or are responsible for;
- work with Defra and the Office for National Statistics (ONS) to include natural capital into the national accounts; and,
- develop ways of measuring natural capital and identifying which assets are at risk.

To address this issue the Natural Capital Committee has developed an accounting framework to show how the value of the flow of services that natural capital and green infrastructure provides is properly understood and reflected in the economy and policy-making *(see Box below)*.

Accounting for Value

Natural Capital Accounting

The Natural Capital Committee recommends the use of its 'natural capital accounting' framework[61]. The purpose of the framework is to help organisations make better decision about the value of the services provided by the natural capital assets (or green infrastructure) that they own and manage.

Whilst the value of most of the services provided by local authority's capital assets (buildings, structures, etc.) is routinely assessed, the same cannot be said for green infrastructure. As a result, its ability to provide goods and services now and in the future is under-appreciated. The natural capital framework is designed to address this gap by:

- measuring the value that the natural capital owned/ managed by an organisation produces for the organisation itself and society in general (asset values); and
- recording the costs (liabilities) of maintaining this value.

However, to date, the natural capital accounting framework has been piloted on relatively large, rural land-holdings and with corporate rather than public partners. This limits the current scope and applicability of the framework, despite the fact that the Natural Capital Committee estimates that urban green infrastructure can "*offer significant potential for improvements in physical and mental health which in turn will reduce health expenditures and improve labour productivity*". This would result in an estimated reduction in health treatment costs alone of £2.1billion.

The Natural Capital Committee also recommends the use of other methodologies, such as i-Tree Eco[62], to help reveal the economic value of specific elements of green infrastructure.

Concurrent with the preparation of this report, an i-Tree Eco assessment has been undertaken for London, which helps to place a value on the services provided by London's 'urban forest' i.e. London's woodlands and trees in streets, gardens and parks. Full details of the i-Tree Eco assessment are available in a separate report, but highlights of the assessment are provided in the Box below.

Revealing the Economic Value of Green Infrastructure

i-Tree Eco assessment

Several methodologies have been developed to identify the economic value of some of the benefits that green infrastructure provides. The most widely adopted and accepted methodology is the i-Tree suite of tools, which enables a valuation to be made of several of the services and benefits provided by the 'urban forest' such as carbon storage, carbon sequestration, abatement of air pollution and reducing stormwater management.

An i-Tree Eco assessment of London[63] has been undertaken. This indicates that the economic value of London's urban forest comprises:

- stormwater alleviation = 3,414,000m^3 per annum worth £2.8million
- carbon storage = 2,367,000t per annum worth £146.9million
- pollution removal = 2,241t per annum worth £126.1million.

The i-Tree Eco assessment of London also shows that the cost of replacing the asset provided by London's urban forest would equate to £6.12billion.

In its final advice to Government published just before the end of the fixed term (30th September 2015) of the current Committee, the NCC stated that the most important point resulting from their work is "*the scale of the economic benefits that could be obtained from better protecting and improving natural capital and the economic losses that could arise from failing to do so. Our work not only shows that the economic returns of environmental investment are comparable and sometimes greater than those of conventional infrastructure investment, but also that the cost of not taking action can be huge.*" Consequently the NCC's key recommendation is for the Government to prepare and implement a 25-year natural capital plan.

Importantly the NCC recognised that green infrastructure provides significant, cost-effective benefits, and given that over 80% of England's population now lives in urban areas,

the quantity and quality of green infrastructure in our urban areas is of critical importance.

In its response[64] to the NCC's third report the Government has agreed to produce a 25-year plan for a 'healthy natural economy' and to extend the life of the Committee until at least the end of the current Parliament.

Recommendation 12

The Mayor should work with the Department for Environment, Food and Rural Affairs, and the new Natural Capital Committee to ensure London's green infrastructure is central to the Government's national 25-year natural capital plan.

Recommendation 13

The Mayor, London Councils and the City of London, should further test the natural capital accounting framework to determine its applicability to a portfolio of public sector green infrastructure assets and ensure this framework becomes a necessary tool for informing investment decisions.

Recommendation 14

The London Enterprise Panel should help develop the frameworks for valuing green infrastructure to ensure that future investments take proper account of the potential for green infrastructure to deliver economic objectives.

East Village. Managing stormwater and improving water quality through green roofs, bioswales and detention ponds. © LLDC

Section Footnotes

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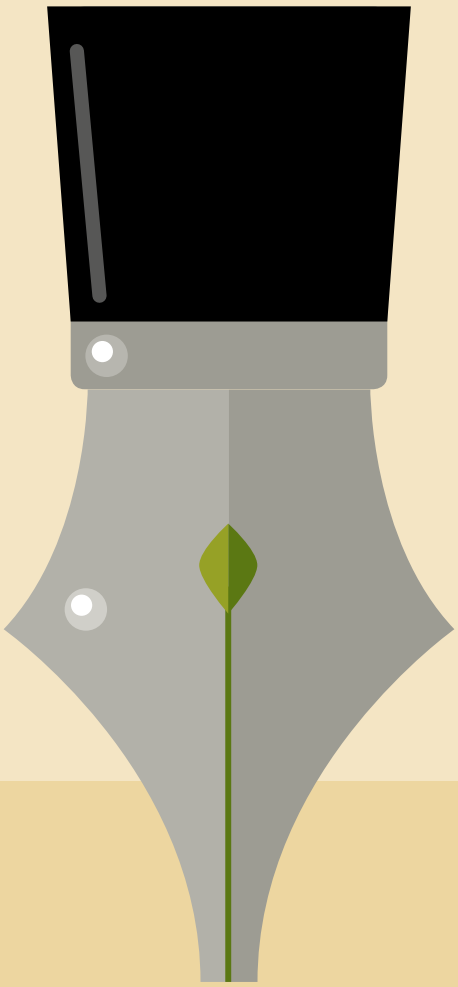
Section Three:

Restructure Governance



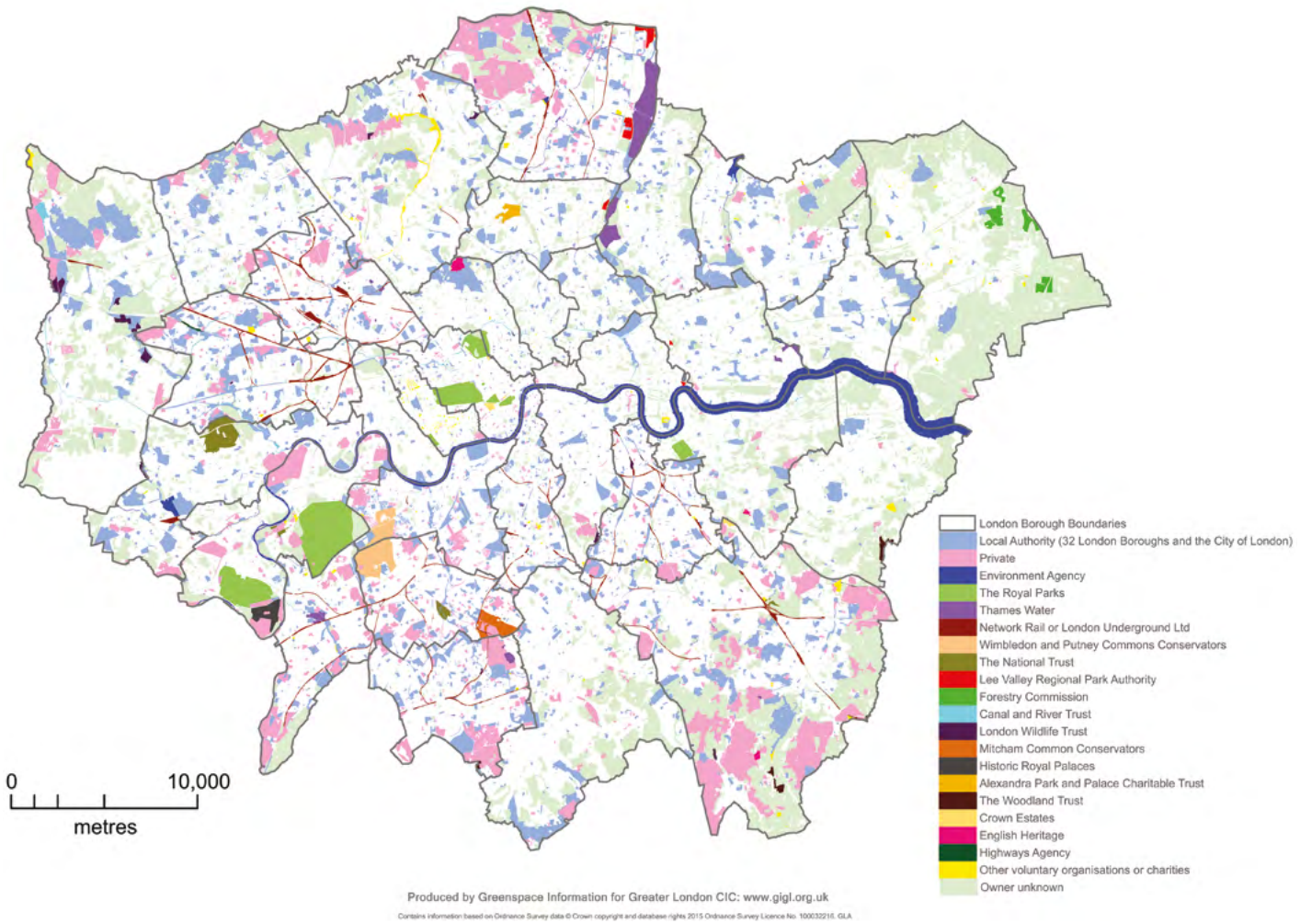
Securing Efficient Delivery of Green Infrastructure in the Future City

Managing green infrastructure to maximise its benefits is challenging. This is partly because of the current complexity in its ownership, management and funding arrangements. This fragmentation results in much of the network being considered as a series of individual spaces with local, or at best borough-wide, objectives.

Complex Ownership and Management Arrangements

The governance of London's green infrastructure has always been complex due to the wide range of organisations involved in its ownership and management. In the public sector alone, this includes: 32 boroughs, the City of London, the Royal Parks Agency, the Lee Valley Regional Park Authority, the London Legacy Development Corporation, and over 20 separate park trusts *(see Figure 5).*

Figure 5: Green Space Ownership in London



Footnotes for this section are on page 39

This complexity is increasing as:
– local authorities look to devolve or divest some of their green space portfolio to community groups, land-management trusts or the voluntary sector;
– land-management charities (such as the National Trust and the Wildlife Trusts) explore opportunities for taking on the management of land beyond special sites;
– private-sector institutions, such as Business Improvement Districts[65], become actively involved in public realm improvements; and
– the increasing amount of privately-owned public space, where land-owners permit access but retain control and ownership (for example the expected increase in roof gardens to provide public open space in the most densely developed parts of the city).

In particular, the London boroughs, the owners and managers of a considerable proportion of the existing resource, have embarked upon a process of shared services and contracting out of parks services to secure efficiencies and cost savings *(see Box below)*. This has sometimes been undertaken in combination with a transfer of ownership or management of some spaces to community groups, NGOs or community interest companies as part of the drive to devolve more decision making and control back into the hands of communities. Whilst this can result in short-term cost savings it could potentially further complicate a more strategic approach to green infrastructure delivery that could provide longer term savings and economic benefits.

London Borough Parks Services – Emerging Contracting Arrangements

Until the early 1980's all local authorities managed their parks as in-house services/direct labour organisations. However, the introduction of compulsory competitive tendering led to many services being outsourced to gain efficiency and cost savings. For many years a mixed picture of in- house and outsourced contracts continued, but more recently there has been an *ad hoc* pursuit of a wide range of contractual solutions.

Today about 60% of boroughs have contracted out their parks services. Some contracts are single grounds maintenance contracts (including parks, housing, schools and highways) and some are multiple facilities management contracts (included with waste or street cleansing). The most recent developments are: boroughs sharing or merging services; transferring all their assets to a trust; or for 'blue collar' staff to be transferred to the contractor.

As a consequence, harmonising contracts to achieve economies of scale and strategic delivery may be problematic, as individual boroughs have entered into contracts at different times and the contracts generally run for between four to six years often with an option to extend by two to five years.

Source: London Parks and Green Spaces Forum[66]

Other public sector managers of London's green infrastructure are also addressing the new fiscal climate of reduced grant or direct support by looking to secure more sources of external income. For example, the Royal Parks Agency has gone from a position in 2003/4 of receiving almost £30million grant-in-aid from the Department of Culture, Media and Sport versus £5million internally generated income to a position in 2015/16 where grant-in-aid has decreased to under £15million and internally generated income has increased to over £20million[67].

Other public bodies have begun to explore relationships with the private sector, including Business Improvement Districts (BIDs)[68], to share expenditure on green infrastructure and public realm improvements through for example initiatives such as Greening the BIDs[69] *(see Case Study 5)*.

Case Study 5: Greening the BIDs

The London Plan sets out the Mayor's ambition to increase green cover in central London by 5% by 2030 and 10% by 2050.

Cross River Partnership manages the Greening the BIDs[70] project for the Greater London Authority, working with Business Improvement Districts and the wider business community. The project contributes to the objectives of the Mayor's green infrastructure framework, the All London Green Grid.

Fifteen central London BIDs have completed Green Infrastructure Audits, identifying the opportunity for 300 rain gardens, 200 green walls and more than 100ha of green roofs across central London. The auditing process has encouraged private sector investment in green infrastructure delivery, contributing to improvements to the public realm in some of the most developed parts of the city, including the Rubens Hotel green wall in Victoria.

The Rubens at the Palace Hotel Living Wall.
© Red Carnation Hotels

Whilst reducing costs and promoting localism are legitimate and appropriate responses to the prevailing policy and fiscal requirements, there is a tension with the proposed green infrastructure approach which, by definition, requires a degree of strategic co-ordination and long-term planning and investment.

Just as a more strategic and outcome-based approach to the design and management of green infrastructure has the potential to maximise the benefits it provides, a more co-ordinated approach to the governance and funding of London's green infrastructure could provide efficiencies and savings by:

– joint delivery of common outcomes; joint-procurement and contracting;
– maximising joint-investment opportunities;
– consolidating administrative functions; and
– convening partnerships that have the capacity to catalyse and steer delivery at different scales.

What are the Governance Options?

New governance arrangements could be applied at different scales and geographies that are most appropriate to maximising the functions of green infrastructure.

1. Neighbourhood Level Governance

In recognition that traditional models of local authority funding are no longer likely to provide sufficient resources to maintain and enhance the public realm, the Association for Public Service Excellence (APSE)[71] recently published a report *Park Life, Street Life: Managing demand in the public realm*[72]. The report explores how local residents, businesses and community groups can become more powerful actors within the public realm, helping to secure not just volunteer hours but access to funding streams, and playing an active role in the management of local spaces. The key message of the report is that local authorities (and others) need to increase the breadth, depth and volume of community involvement in the public realm.

At the neighbourhood scale, varying degrees of management could be devolved to ward or community based organisations. This has been an objective of Central Government policy, for example through the 'Big Society' initiative, and is being pursued through the more recent 'localism' agenda enshrined by the Localism Act 2011[73]. This allows local authorities to consider transferring assets with a financial endowment to help support long-term management, using their discretionary power to promote community well-being. This has resulted in innovations, such as the proposal[74] by Vauxhall One and Vauxhall City Farm to manage five local parks through Lambeth's Co-operative Parks initiative *(see Box below)*.

Lambeth Co-operative Parks Programme

Lambeth identified itself as a 'Co-operative Council' in 2013 with a commitment to work more collaboratively with local communities to deliver local services. In applying this concept to its parks and green spaces portfolio it has developed a three-tier model for parks and green space management[75]:

Tier 1: Council management – major spaces managed by the council and its contractors.
Tier 2: Co-operative management – a partnership between the council, local community representatives and local organisations to ensure joint decision-making.
Tier 3: Community management – community groups and supporting partner organisations take responsibility for management with the council performing a monitoring role to ensure appropriate standards.

The Vauxhall Initiative

In response to the Co-operative Parks Programme, Vauxhall City Farm and Vauxhall One (in co-operation with the Friends of Vauxhall Park) have expressed interest in taking over the management of five Lambeth parks[76] – Vauxhall Park, Vauxhall Pleasure Gardens, Pedlars Park, Old Paradise Street Gardens and Albert Embankment Gardens – all of which are within 10 minutes' walking distance of each other.

The partners consider that the most practical (and cost-effective) approach is to think about them as a whole, linked by a Vauxhall Green Trail connecting to the proposed Nine Elms linear park to Battersea. The partners propose to establish a Charity or Community-Interest Company with a two-tier structure comprised of a Trustee Board and a Vauxhall Parks Council.

2. Borough Level Governance

The administrative geography of the borough will remain the primary basis on which to plan and manage much green infrastructure. This is because of the inextricable link with land-use planning, the delivery of services such as public health, and the management of much of the public realm in partnership with local stakeholders.

To reconcile this with a city-wide green infrastructure strategy and to ensure joined-up delivery, there needs to be collaboration between those responsible for management of the physical green infrastructure assets and those responsible for the delivery of wider environmental and socio-economic outcomes.

A similar issue was recognised when the Health and Social Care Act (2012) transferred greater responsibility to local authorities to co-ordinate and prioritise public health and social care programmes. Statutory Health and Well-being Boards[77] were created to oversee joint approaches to health delivery. A similar, albeit non-statutory, approach for green infrastructure could be achieved by ensuring that green infrastructure planning and delivery is seen as an essential part of a 'placemaking'[78] agenda within local authorities (see *Box on next page*). Indeed both the *Public London Insight Study*[79] (2015) and the *Farrell Review* (2013)[80] highlight the importance of interdisciplinary placemaking within local authorities.

What is Placemaking?

Placemaking is an integrated approach to the planning, design and management of public spaces. It requires a collaborative process through which public realm is shaped to maximise shared value. Placemaking pays particular attention to the relationship between the physical, cultural, environmental and social components that define a place to inform the regeneration or evolution of that place.

Placemaking shows people how powerful their collective vision can be. It helps them to re-imagine everyday spaces, and to reveal the potential of parks, neighbourhoods, streets, and the wider public realm when these are considered in a more holistic way.

Several London boroughs are embracing the concept of placemaking (or placeshaping). The London Borough of Camden[81] has developed Place Plans for several parts of the borough and the London Borough of Croydon's Connected Croydon[82] initiative aims to improve and integrate Croydon's streets, squares and open spaces.

Recommendation 15

London boroughs should ensure that the concept of green infrastructure is central to a placemaking agenda and properly represented within their placemaking teams.

3. Sub-Regional Governance

It is clear from the evidence and analysis in this report that delivering some of the key functions of green infrastructure requires at least sub-regional thinking and programmes of delivery to optimise the services provided by green infrastructure. This was the rationale for the establishment of the Lee Valley Regional Park Authority as far back as 1966.

More recently, there have been various attempts to establish non-statutory partnerships to plan and manage green infrastructure at a sub-regional level. These include:

- The Colne Valley Regional Park[83] (created at the same time and for the same reason as the Lee Valley Regional park but without the latter's formal powers and duties).
- The South East London Green Chain[84] (set up to promote connectivity between existing green spaces).
- The Thames Chase Community Forest[85] (established to create a forested landscape to promote recreation and access).
- The Wandle Valley Regional Park Trust[86] (created to help deliver the aspiration to establish a Wandle Valley Regional Park).

A more comprehensive approach to establishing sub-regional partnerships was undertaken following the publication of the All London Green Grid Supplementary Planning Guidance. With funding from the former London Development Agency[87], these partnerships were established to encourage more joined-up working across borough boundaries; to promote joint initiatives; to develop landscape-scale approaches to delivery; and to explore synergies with other sectors. Some of these partnerships, have been able to co-ordinate projects that contribute to area-wide rather than purely site-based objectives.

The Wandle Valley Regional Park Trust[88] *(see Case Study 6)* has been in receipt of core funding from the National Trust and the four participating boroughs – Wandsworth, Merton, Sutton and Croydon. The borough funding is derived in part from the reduction in the levy achieved by the Lee Valley Regional Park Authority over the past five years[89] *(see Box at bottom of page)*. But this funding is not secure and other existing sub-regional partnerships remain inadequately resourced.

Case Study 6: Wandle Valley – a New Model for a Regional Park?

Following the completion of a governance study in April 2011, the Wandle partners (including the London boroughs of Croydon, Merton, Sutton, and Wandsworth; the Environment Agency, National Trust, and the GLA) established the Wandle Valley Regional Park Trust to provide leadership, vision and coordination, and ultimately the funding to deliver a regional park over the next decade.

The Trust was constituted as a Limited Company in July 2012 and became a charity in July 2013. The partners believe a charitable company is the best 'business model' to allow the regional park to grow over the next three to five years.

The Lee Valley Regional Park Authority Levy

Lee Valley Regional Park Authority (LVRPA) is an independent statutory public body established by an Act of Parliament to run the 10,000 acre, 26 mile long Lee Valley Regional Park, which stretches from the River Thames, through inner London and Essex to Hertfordshire.

The Authority generates over half of its £25million annual funding by its own commercial and investment activities. The rest comes from a levy on council tax payers in Greater London, Essex and Hertfordshire equating to £0.98 per person per year. This levy has been discussed for some time, with boroughs more distant from the Lee Valley questioning the benefits they receive from the work of the LVRPA. Conscious of this, the LVRPA has achieved a levy decrease of 2% per annum for five consecutive years to 2015/16 – delivering cash savings of £1.15million.

Furthermore, other partnerships exist that have complementary objectives and functions. For example, the Thames Regional Flood and Coastal Committee[90] encourages efficient, targeted and risk-based investment in flood risk management, and Catchment Management Partnerships in London[91] actively involve communities and other stakeholders in restoring their local rivers, tackling pollution, managing invasive species, and improving access to rivers.

At a more strategic level, cross-borough partnerships have been established to cover issues such as waste[92] and transport[93]. Boroughs have also formed strategic alliances to ensure a more joined-up approach to issues such as infrastructure, skills, shared-services and devolution. These include the West London Alliance[94], the South London Partnership[95], Central London Forward[96] and the North East London Strategic Alliance[97].

Recommendation 16

The Greater London Authority, London Councils and the Environment Agency should review existing relevant partnerships to identify opportunities for better collaboration and co-ordination of green infrastructure.

Recommendation 17

Boroughs should support sub-regional green infrastructure partnerships. These partnerships should be funded by the Greater London Authority matched by an allocation from the boroughs, for example, from savings generated through the reduction in the levy achieved by the Lee Valley Regional Park Authority over the past five years.

4. London-Wide Governance

Many of the international cities of comparable in size and/or status to London (e.g. New York[98], Paris[99], Berlin[100], Singapore[101] and Hong Kong[102]) have city-wide authorities with responsibility for the development and management of the green infrastructure of their cities. In the UK, cities such as Birmingham[103] and Manchester[104] are developing city-wide green infrastructure plans. The ability of these cities to develop and deliver their green infrastructure programmes is, in part, due to their ability to undertake strategic interventions as a consequence of city-wide governance arrangements. Models of governance that are widely recognised to be particularly effective are the Minneapolis Parks and Recreation Board[105] and Grün Berlin GmbH *(see Box below)*.

Governance Models from Other Cities

Minneapolis Parks and Recreation Board

The Minneapolis Park and Recreation Board (MPRB)[106] is an independently elected, semi-autonomous body responsible for governing, maintaining and developing the Minneapolis Park System.

Its independence allows the Minneapolis Park and Recreation Board to focus on providing and obtaining the resources necessary to accomplish its mission and form effective, responsible partnerships. It's funding is based on a levy imposed on all the taxable property in the city and a system of fees and charges for use of park facilities.

Grün Berlin GmbH

Grün Berlin GmbH[107] is the private not-for-profit service company of Berlin city region for all open space development projects and the project management of these projects. Although it has a limited role in direct park management it is responsible for marketing and event marketing across Berlin's parks and green space network, closely linked to the promotion and leveraging of tourist potential and promoting Berlin as a green city with a high quality of life.

Grün Berlin was established in recognition that the challenges faced by the city required new strategies and approaches in open space development and management. The organisation is based on the principle that the ecological, social, cultural and economic targets of a sustainable development can only be achieved via an integrated approach to urban and open space development.

But London has a different set of more complex governance arrangements and these are likely to stay in place for the foreseeable future. The existing Transport and Environment Committee[108] (TEC) of London Councils represents London boroughs' views on the development and implementation of the whole range of transport and environment policies generated by Europe, national government or the Mayor of London; alongside its statutory functions. TEC could play a greater role in strengthening city-wide green governance for green infrastructure in order to achieve a better level of integration and joint-planning than is currently the case. However, this would need sufficient legitimacy to steer and support green infrastructure delivery through ensuring better collaboration between key agencies, such as the London boroughs, City of London, Environment Agency, Greater London Authority, Public Health England, Transport for London, Royal Parks Agency, and the Lee Valley Regional Park Authority and the increasingly important players and stakeholders in the voluntary and private sector.

There are existing precedents based on different levels of formality, authority and administration, including:

– The London Food Board[109]: an advisory group of independent food policy organisations and experts

which oversees the implementation of The Mayor's Food Strategy with a Chair appointed by the Mayor on an informal basis.
- A London Cycling Commissioner: formally appointed under section 67 (1) (a & b) of the GLA Act 1999 with a remit to engage with local boroughs and the cycling community, working with TfL to develop and implement cycling policy, and to champion cycling within and outside of the organisation.
- London Highways Alliance[110]: a joint initiative between TfL and London's boroughs to provide a collaborative approach to highway management, aiming to reduce costs and promote best practice by shared management systems and collaborative procurement.
- London Waste and Recycling Board[111]: a statutory board established by the GLA Act 2007 to provide a strategic approach to waste management in London. The Board is chaired by the Mayor of London (or his representative). As well as the Chair, the membership comprises four councillors and two independents nominated by London Councils and one independent appointed by the Mayor of London.

The establishment of a formal Board (or an entity similar to Grün Berlin, for example) has some merit as it would help to simplify current arrangements, promote consistency and could deliver potential efficiencies such as joint procurement, marketing and more shared services.

However, the establishment of a new layer of administration is not appropriate in the medium term whilst there is an ongoing debate about the level of devolution of services and budgets from central to local government.

Our recommendations below acknowledge the need for stronger leadership on green infrastructure within the context of existing administrative arrangements. We propose a Green Infrastructure Commissioner, on the model of the cycling Commissioner, under section 67 (1) of the GLA Act.

Recommendation 18
The Mayor should appoint a Green Infrastructure Commissioner to advocate, promote and develop an integrated green infrastructure for London.

Recommendation 19
London Councils Transport and Environment Committee should take a stronger role in promoting, co-ordinating and supporting green infrastructure.

Constructed wetland designed to improve water quality and enhance ecology. © Biodiversity by Design

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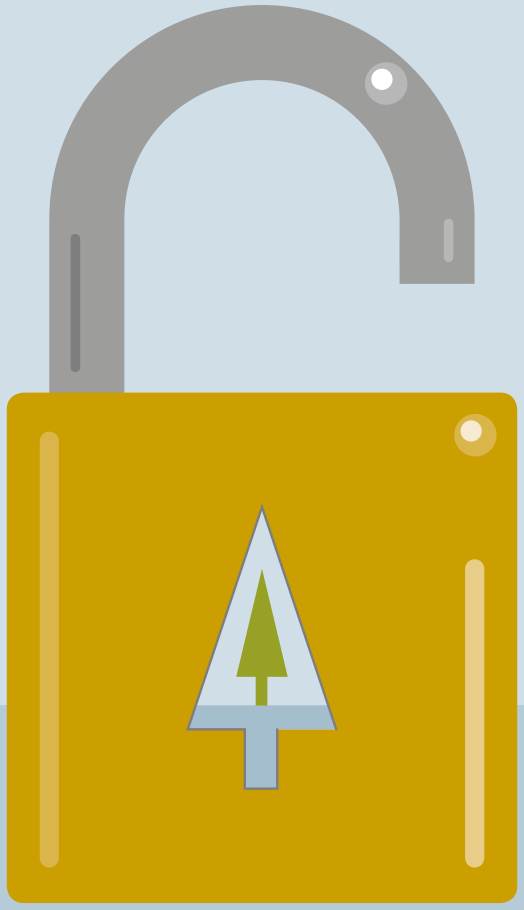
Section Four:

Release Funding



New Sources of Green Infrastructure Finance in the Future City

Reframing our understanding of the value of green infrastructure (as discussed in Section Two) is likely to make a considerable difference to decisions about the allocation of existing resources and, consequently, a redirection of existing funding to green infrastructure delivery. However, there will also need to be new funding streams identified, particularly in the short-term, to begin the process of retro-fitting existing green infrastructure so that it is reconfigured to meet the five green infrastructure objectives highlighted in Section One.

This issue was addressed in a report, *Paying for Parks*[112], published by CABE Space, the former agency advising Government on the planning, design and management of public space.

The report identified eight models for funding urban green spaces and indicated their strengths and weaknesses and how they could be applied:

– Traditional local authority funding
– Multi-agency public sector funding
– Taxation initiatives
– Planning and development opportunities
– Bonds and commercial finance
– Income-generating opportunities
– Endowments
– Voluntary and community sector involvement.

Footnotes for this section are on page 45

The report suggested that some of these models can be more readily applied to access finance in the short term but that other models require more long-term developmental work and radical thinking but could play an important role in funding green space in the future.

This has indeed proved to be the case. Since the publication of *Paying for Parks* in 2006 by CABESpace there has been some significant innovation in funding for parks and green infrastructure particularly with respect to the deployment of traditional local authority funding, increased income generation (mainly from sport and leisure activities) and the involvement of the voluntary and community sectors in direct management, particularly of smaller spaces. However, there has not been the long-term developmental work and radical thinking suggested by the CABESpace report.

But the emergence of the green infrastructure concept, together with a recognition that the traditional local authority funding model is not able to provide long-term green infrastructure funding, may provide the necessary catalyst for the more innovative thinking advocated by CABESpace. Outlined below are examples of such approaches.

Building Capacity

Over his term of office the current Mayor (Boris Johnson) has invested over £2million per annum on projects designed to show how green infrastructure can be delivered throughout the public realm. Initiatives such as his Big Green Fund[113] and Pocket Parks[114] programmes have been designed to encourage local authorities and local communities to deliver public realm improvements that demonstrate the objectives of green infrastructure. Projects funded have included river restoration schemes in Mayesbrook Park[115] and Wandle Park[116], and the creation of civic spaces such as Derbyshire Street Pocket Park[117] *(see Case Study 7)*, which incorporates sustainable urban drainage and new cycling infrastructure.

This pump-priming of green infrastructure projects provides both case-studies and show-and-tell projects that help embed the concept and demonstrate that these schemes are both deliverable and effective.

Recommendation 20

The Mayor should continue to provide pump-prime funding that matches or betters previous Mayoral funding programmes to ensure a pipeline of good practice case-studies of green infrastructure design and delivery.

The Case for a Proportionate Share of New and Existing Infrastructure Funding

Raising the Capital[118], the report of the London Finance Commission[119], calls for greater financial freedom for London in order to improve the city's infrastructure.

Case Study 7:
Derbyshire Street Pocket Park

The eastern end of Derbyshire Street, Bethnal Green, was a dead-end road with only one function – space for twelve car-parking bays. Despite the surrounding urban spaces being a hive of activity, the dead-end provided only an opportunity for anti-social behaviour and fly-tipping.

Proposals were prepared that sought to recognise its potential as an important node for pedestrians and cyclists. A small section of unused green space (within the adjacent park) was also incorporated into the scheme, offering connectivity as well as the opportunity to deliver on proposals for sustainable urban drainage (SuDS). Funding for the project was secured from the Mayor of London's pocket park initiative – match-funded by Tower Hamlets.

The design incorporates the cycle lane, new seating, green-roof covered bike racks and bin stores, a rain-garden and a defined area for café tables and chairs. Bespoke planters that capture rainwater from the roof of Oxford House were designed and donated by Thames Water.

Further information
http://greysmithassociates.com/project/pocket-park/

Derbyshire Pocket Park (before).
© Greysmith Associates

Derbyshire Street Pocket Park (after).
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It recommends that London should be given control over property taxes, including council tax, stamp duty and business rates, as well as the ability to levy new taxes, such as a tourist tax.

The case for fiscal devolution was restated in the London Infrastructure Plan 2050. This Plan recognises that fiscal devolution will enable the city to have greater financial control over its own transport, housing and other infrastructure investments; it will provide a fiscal base against which to borrow prudently; and it will allow for more targeted decisions regarding additional investments in other infrastructure.

The case for investing in green infrastructure is made well in the London Infrastructure Plan and so it is logical that, as and when fiscal devolution occurs, there should be investment in green infrastructure consistent with its significance in the London Infrastructure Plan.

Recommendation 21
The Mayor should ensure that green infrastructure receives a proportionate share of any infrastructure funds resulting from the proposals for further fiscal devolution.

Recommendation 22
The London Enterprise Panel and the Infrastructure Delivery Board should ensure that green infrastructure outputs are delivered through other infrastructure funding for surface transport, high streets, housing and regeneration.

A Case for Levies on Environmentally Detrimental or Unhealthy Activity?

The London Finance Commission report also argues for allowing London government to introduce levies on environmentally detrimental or unhealthy activity to assist in delivering wider public good objectives. This approach has been trialled in other cities, notably in the United States where locally imposed levies have been used effectively to generate funding for managing the adverse effects of stormwater, or to green residential areas *(see Box below)*.

Local Levies – the US Model

Stormwater Credits

In Washington, where urban storm-water runoff is the fastest-growing contributor to pollution, the district's government has created a new marketplace in which green infrastructure is a tradable asset[120]. Property owners who build green roofs, rain gardens and the like are given stormwater credits that they can sell to others who need to offset the runoff from their developments. The system is designed to increase water collection more cost-effectively than traditional approaches and to support green-infrastructure entrepreneurs.

Green Benefit Districts

In San Francisco, the neighbourhoods known as Dogpatch and Northwest Potrero Hill recently established the country's first Green Benefit District (GBD)[121]. Through the programme, property owners pay a small levy towards maintaining and improving parks and green spaces. It is modelled on the Community Benefit District (CBD) programme – which is similar to Business Improvement Districts in the UK – but is geared toward greening a residential area, as opposed to improving commercial districts.

N.B. In London, Camden is trialling a similar approach through the proposal to create a Parks Improvement District[122] funded by a voluntary levy of local businesses that benefit from their proximity to the green squares in Bloomsbury.

The UK Government has previously explored the concept of 'biodiversity offsetting'[123], a mechanism to compensate for losses that aim to ensure that when a development damages nature (and this damage cannot be avoided) new, bigger or better nature sites will be created. [N.B. Biodiversity offsets are different from other types of ecological compensation, as they need to show measurable outcomes that are sustained over time].

Recommendation 23
The Mayor and London Councils should identify the scope for additional levies or compensatory mechanisms on environmentally detrimental activity that could assist in funding green infrastructure projects. These should include, for example, 'stormwater credits' and 'biodiversity offsetting'.

Establishing a London Green Infrastructure Foundation

The recent high profile campaign to declare London a National Park City[124] has demonstrated that there is a considerable support for a common, city-wide identity that would help raise the profile of London's green infrastructure and the benefits it provides *(see also Recommendation 10)*. The promoters of the campaign have indicated that the delivery of their idea would not require public funding but could be funded through private and corporate giving based on some of the philanthropic models (such as parks conservancies or parks foundations) developed in the United States. This is worth further exploration potentially using the National Park City brand as a promotional vehicle.

Securing a substantial funding base for modern green infrastructure investment through corporate donations or philanthropy has not been widely tested in the UK. This is partly because different cultural norms and tax-regimes mean that the philanthropy model is less well-developed here than in the US. Nevertheless, the model has been successful in the US, with the New York Restoration Project[125] being a notable example *(see Box below)*. As London continues to develop as a world-city and as a base for global corporate entities and high-wealth individuals, the potential to develop a corporate donor/philanthropic funding model is likely to increase.

Improving the City One Space at a Time

The New York Restoration Project (NYRP) is a non-profit organization established to help ensure that all New Yorkers have access to high-quality green space within walking distance of their homes. Since being founded in 1995, the NYRP has planted trees, renovated gardens, restored parks, and transformed open space for communities throughout New York City's five boroughs.

Unlike traditional parks conservancies that care for a specific place, NYRP is the only New York City conservancy that works citywide, bringing private resources to spaces that lack adequate municipal support, fortifying the City's ageing infrastructure and creating a healthier environment for those who live in the most densely populated and least green neighbourhoods.

Recommendation 24

The Mayor should explore with the National Park City campaign how a Green Infrastructure Foundation could be created and operated.

Establishing a Natural Capital Resource Fund

A resource fund is based on the notion that some of the value derived from depletion of a natural non-renewable resource should be invested in an endowment fund to deliver social or environmental benefits to society.

The practice of establishing non-renewable resource funds has become widespread in the energy sector, investing some of the value derived from the extraction and use of fossil fuels to fund renewable energy projects.

Existing green infrastructure in London is effectively a non-renewable resource and the depletion of this non-renewable resource is an unsustainable use of an asset unless the benefits and services provided by the resource are fully compensated for.

Despite reasonably strong planning controls in London that have helped to prevent wholescale loss of green space to development, it is almost inevitable that there will be some continuing depletion of the base resource. However, the value of this resource is high and is likely to increase as London grows. Capturing this value, should some of the resource be lost to other land-uses, is a logical extension of the Resource Fund model.

The barriers to establishing such a resource fund are considerable, not least because the concept is based on the contentious idea that value would be generated by some depletion of the existing asset. Nevertheless it is worthy of further investigation to determine its potential, especially in the case of London where the depletion of some of the existing natural capital is inevitable as a result of development to meet the needs of a growing population.

The precedent of investment in an endowment fund to generate income to support infrastructure was established by the funding mechanism used for the upkeep of the bridges into the City of London. An endowment is held within the charity Bridge House Estates, which must ensure sufficient funding for the maintenance of five of the bridges across the Thames. Any surplus monies generated by the endowment are distributed by the City Bridge Trust[126], Bridge House Estates' grant-giving arm, to fund other charitable purposes benefitting Greater London.

Recommendation 25

The City of London, with support from the Greater London Authority, should undertake a study into the potential for a Natural Capital Resource Fund.

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Next Steps

In preparing this report we have tried to illustrate how important it is that the existing and potential services provided by London's green infrastructure are fully appreciated, and why it should be considered on a par with other infrastructure needed by a growing city. Implementing the recommendations of the Task Force's report would result in a more coherent, efficient green infrastructure. Creating a London that is more attractive, better connected, healthier, and more resilient place that people can take pride in.

Consequently, we have:
- Highlighted the functions, services and benefits of green infrastructure.
- Provided examples, evidence and analysis demonstrating how green infrastructure can provide appropriate solutions to the challenges that London faces.
- Identified the methodologies that help present the economic case for investment.
- Sign-posted governance, institutional and funding arrangements that are likely to be more appropriate in supporting the delivery of green infrastructure.
- Made a series of recommendations for how this step-change can be achieved.

We hope we have provided a sound and well-argued report and that the recommendations receive widespread support and endorsement. The following headline recommendations are those that we consider should be implemented as a priority:
- **Appoint a Green Infrastructure Commissioner, who should initiate a public-facing campaign to raise awareness of the value and benefits of green infrastructure**
- **Investigate opportunities to raise funding for green infrastructure, particularly:**
  - Ensure a future Mayor continues to pump-prime green infrastructure projects at a level that matches or betters previous mayoral programmes. This will support sub-regional partnerships to improve collaboration, co-ordination and delivery of green infrastructure
  - Create a Green Infrastructure Foundation and a Natural Capital Resource Fund to support the long term, sustainable funding of green infrastructure
- **Update the All London Green Grid, based on new evidence and natural capital accounting or other valuation methodologies. This will inform green infrastructure delivery strategies for all opportunity areas, as well as inform new green infrastructure targets.**

However, this report is also intended to provoke discussion and debate. Our recommendations are informed by the current context and a considered view as to how the political, physical, environmental and socio-economic landscape of London will change over time. Nevertheless, we acknowledge there are uncertainties and unknowns, and issues which may seem rather insignificant now could have more profound impacts in the future.

We would value your views on this report. We will review all comments received and reconvene the Task Force in Spring 2016 to refine and update our recommendations as necessary.

Please submit your views and comments to the Green Infrastructure Task Force secretariat – peter.massini@london.gov.uk

Your comments should be received by 26th February 2016.

John Lewis Rain Garden – improving the public realm and reducing stormwater flows. © Nigel Dunnett

St James's Park reedbeds and wildflowers.
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