



Department  
for Environment  
Food & Rural Affairs

# Local Action Project

## Final report WT1580

November 2016

# **Local Action Project**

## **Final report WT1580**

Produced: November 2016

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**Authors:** West Country Rivers Trust

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# LOCAL ACTION PROJECT

Ecosystem services in urban water environments (Project WT1580)

*Working with local communities to enhance the value of natural capital in our towns, cities and other urban spaces to improve people's lives, the environment and economic prosperity.*

**Final Report – November 2016**

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*Rain Charm House, Kyl Cober Parc, Stoke Climsland, Callington, Cornwall, PL17 8PH.*

*Tel: 01579 372140; Email: [info@wrt.org.uk](mailto:info@wrt.org.uk); Web: [www.wrt.org.uk](http://www.wrt.org.uk)*

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## ACKNOWLEDGEMENTS

### Project Team

– Stuart Kirk	Project Manager	Defra – JWEG
– Ashley Holt	Project Executive	Defra Water
– Rich Martin	Urban Pollution	Defra/EA
– Claire Johnstone	Economist	Environment Agency
– Damian Crilly	Expert Practitioner	Environment Agency
– Simon Scanlan	Economist	Defra
– Rachel Lenane	Ecosystem Services	Environment Agency
– Victor Aguilera	Evidence	Defra
– David Furrow	Ecosystem Services	Environment Agency
– Patricia Rice	Ecosystem Approach	Natural England
– Martin Moss	Green Infrastructure	Natural England
– Martyn Evans	Green Infrastructure	Natural Res. Wales
– Alex Collins	NERC Fellow	Defra/JWEG/ICL
– Nick Paling	Technical Lead	Westcountry Rivers
– Sarah Wigley	ESS Mapping	Westcountry Rivers
– Katharina Bauer	Ecosystem Services	Westcountry Rivers



### Local Action Group Members

#### Leicester

– Ruth Needham	CaBA Host	Trent Rivers Trust
– David Newborough	Catch. Coordinator	Environment Agency
– Helen O'Brien	Natural Environment	Leicester City Council
– John Vann	Flood Risk Manager	Environment Agency



#### Thames Estuary

– Amy Pryor	CaBA Host	Thames Estuary Part.
– Kim Holt	Mapping Tech Spec	Thames Estuary Part.



#### Manchester

– Caroline Riley	CaBA Host	Healthy Rivers Trust
– Katherine Causer	Catch. Coordinator	Environment Agency
– Bryan Cosgrove	Evidence Tech Spec	Red Rose Forest
– Jo Fraser	Practitioner	Groundwork
– Cassie Mailvaganam	Practitioner	Stockport Council
– Zorica Todorovic	Practitioner	Manchester Council
– E Ainsworth	Practitioner	Manchester Council
– David Dutton	Practitioner	Tameside Council
– Petula Neilson	Practitioner	Trafford Council



#### Newton Abbot

– Jonny Miller	Green Infrastructure	Teignbridge Council
– Nick Paling	CaBA Host	Westcountry Rivers



### Other Key Contributors

– John Bright	Wheels of Water	Aqualinc Research NZ
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## EXECUTIVE SUMMARY

***Working with local communities to enhance the value of natural capital in our towns, cities and other urban spaces to improve people's lives, the environment and economic prosperity.***

### Introduction

Defra's Local Action Project aimed to work with local communities to enhance the value of natural capital in towns, cities and other urban spaces to improve people's lives, the environment and economic prosperity. It has taken a partnership approach that will enable local communities and civil society groups to discover their vision for where they live and to help them to form effective stakeholder-partnerships that can realise this.

The LAP has assisted in meeting the requirements of Defra's 25-Year Plan to help individuals and organisations understand the economic, social and cultural value of nature, the impact that their actions have on it, and to use this knowledge to make better decisions and facilitate the design of sustainable financing models.

The LAP has also provided research and development outputs that presents robust data, evidence and information on the benefits of green infrastructure and natural capital along with a method that helps communities build consensus, facilitate local decision-making and secure funding for natural capital improvements.

The LAP was funded by Defra (project number: WT1580) and ran from March 2015 to May 2016. The project was led by the Westcountry Rivers Trust who have extensive experience of evaluating ecosystem services and working in partnership with a variety of stakeholders. The Project Board contains members from Defra, the Environment Agency, Natural England, Natural Resources Wales and Imperial College London.

### Project Outputs

The Local Action Plan Project has produced the following outputs:

- 1 Method for assessing opportunities to enhance or create new ecosystem services in urban areas
- 2 Toolbox of interventions to enhance/increase ecosystem services provision in urban areas
- 3 Cost-benefit assessment of the benefits and impacts of those interventions
- 4 Series of case studies piloting the mapping and cost-benefit tools, plus lessons learnt report
- 5 Suite of communication & visualisation tools and a database of good practice examples.

### Opportunities Assessment Method

In order to develop a method that could identify the opportunities to enhance ecosystem services in urban areas, a series of indicators covering the economic, social, cultural and environmental benefits provided by natural capital and green infrastructure were developed. These indicators were based on freely available data and information so that they could be generated for any location within the UK.

Economic indicators included: 1) property values, which have been demonstrated to correlate closely to the aesthetics and quality of an urban landscape, and 2) flood damage costs, which is calculated using the Environment Agency's NaFRA methodology and used as an economic metric of the costs associated with remediation and repair after a flood.

Social metrics used included; 1) access to greenspace, which is calculated as the proportion of people in a community within 10 mins (600m) walk of an accessible greenspace; 2) air quality, using modelled mean background concentration of PM<sub>2.5</sub> obtained from the Defra Air Quality Information Resource; 3) flood risk from rivers and sea, and 4) surface water flood risk. Living at risk of flooding can have severe effects on the health and emotional wellbeing of people and each of these risk indicators is determined from the number of people living at risk of flooding.

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Cultural indicators used included: 1) aesthetic value, generated using the concentration of geo-tagged photos on the social media site Flickr, and 2) the provision of resources for undertaking cultural activities such as clubs and societies associated with open space and natural resources.

Environmental indicators included: 1) water quality, measured by the number of 'urban' Reason for Not Achieving Good Status under the Water Framework Directive classification; 2) water availability, according to the EA's Catchment Abstraction Management Strategies; 3) wildlife habitat availability, measured by the percentage land cover that comprises of priority habitats, and 4) local climate regulation (or urban heat island effect), measured using Landsat 8 thermal imaging data collected in the summer months.

It should be stressed that whilst these metrics have been developed by the Local Action Project so far, work should always be done with input from local groups so that the final metrics reflect the values of local communities.

All of the metrics produced are presented in a wheel graphic to enable easy comparison between the differing metrics (Figure 1) and between different areas.

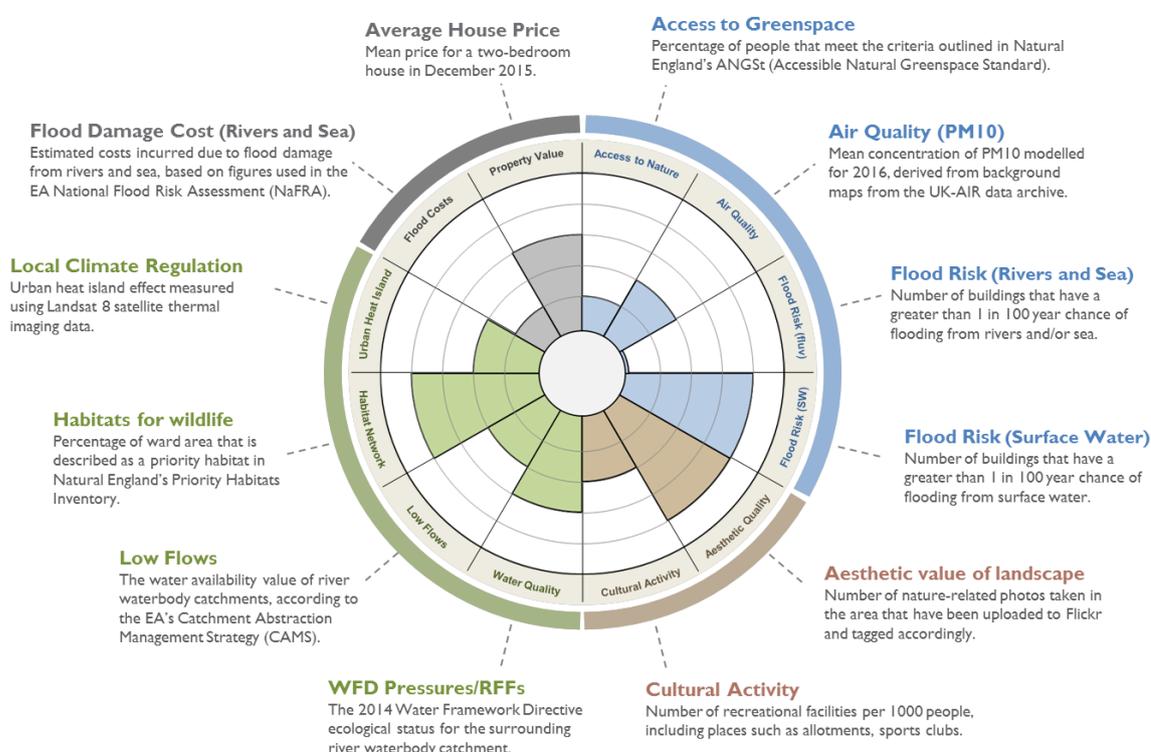


Figure 1: Presentation of the metrics used to describe the economic, social, cultural and environmental benefits provided by natural capital and green infrastructure in an urban area.

Presenting information in this way helps to identify areas that could benefit the most from increased or improved environmental infrastructure and also what types of interventions are appropriate to meet those needs. High resolution hydrological and suitability analyses, along with the identification of areas of opportunity, such as potential development sites can then be used to identify candidate sites for specific interventions.

## Demonstration Areas

The approach developed under the Local Action Project has been developed collaboratively in four pilot areas: Leicester, Newton Abbot, Manchester and Thames Estuary. In each of these areas work has been done with catchment partnerships and local decision makers to provide feedback and refine the approach.

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The current benefits provided by natural capital and green infrastructure have been analysed using the metrics developed for each ward level or super output areas within the pilots. These have been represented geographically so that the levels of service provision throughout the area can be compared (Figure 2).

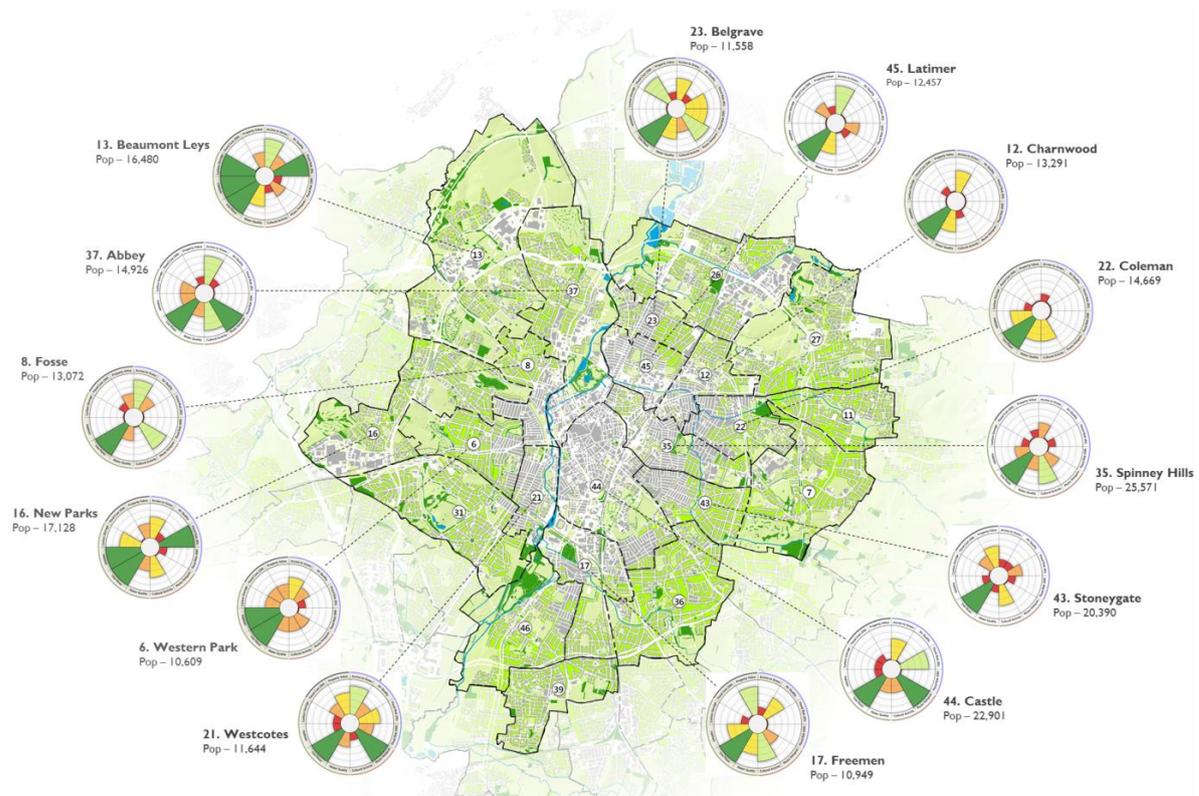


Figure 2: The levels of economic, social, cultural and environmental benefits provided by green infrastructure in each MSOA in the City of Leicester.

Work within the pilot areas has demonstrated that the approach is easily understood by non-technical audiences, engages stakeholders and facilitates conversations around levels of green infrastructure and opportunities for enhancement.

### Intervention Toolbox and Cost-Benefit Assessment

A toolbox of interventions that can be used to enhance service provision in urban environments has also been compiled. These factsheets provide information regarding restoration/regeneration methods, green infrastructure, sustainable urban drainage schemes, and retrofit and greening actions, along with aspects that increase functionality, e.g. increased amenity or access.

For each of these interventions, cost and benefits information and feasibility criteria has been provided. These are being used along with the opportunities maps to create action plans for the improvement of green infrastructure in each of the pilot areas.

### Communication Outputs

Effective communication is vital to the engagement and collaboration with local stakeholders and so the project has also worked to develop a suite of clear, engaging and effective communication outputs carefully designed and tailored to the needs and prior knowledge of a variety of key audiences.

As an example of this, the image below (Figure 3) has been created to give an artist's impression of what a "good" urban area incorporating green infrastructure would look like as opposed to a "bad" urban area with little green infrastructure provision. An interactive annotated version will be produced which can be used to engage partners and encourage interest in local action planning.



Figure 3: The 'Natural value in urban landscapes' illustration (known colloquially as 'Good town – bad town').

## NERC Green Infrastructure Project

Under NERC's Green Infrastructure Programme additional work has been funded to explore how the tools developed by the Local Action Plan project could be developed to assist additional users such as local planning officers, biodiversity officers and ecologists, as well as construction companies. Work is also ongoing to see how the work of the project could help to deliver Defra's 25-Year Plan.

## Find Out More

More information can be found at the project website <http://urbanwater-eco.services/>

Or please contact Alex Collins ([Alexandra.Collins@Imperial.ac.uk](mailto:Alexandra.Collins@Imperial.ac.uk)), Nick Paling ([nick@wrt.org.uk](mailto:nick@wrt.org.uk)) or Ashley Holt ([Ashley.Holt@Defra.gsi.gov.uk](mailto:Ashley.Holt@Defra.gsi.gov.uk)) to find out more.

# I. INTRODUCTION

## 1.1. Ecosystem services in urban water environments

Within urban areas there are numerous benefits that humans derive from the environment, known as ecosystem services (ES). These include the provision of resources that are consumed, the regulating of ecosystem functions such as air quality and climate regulation, non-material, cultural services such as recreation and aesthetic experiences, along with the services that are necessary for ecosystem functioning such as soil formation and nutrient cycling etc. Together these have significant influence on numerous economic activities and on the health and well-being of human inhabitants within cities (TEEB, 2011).

Green infrastructure has developed as a term which enables the natural elements of an urban areas to be considered on the same level as other urban infrastructures such as transport, communications, water supply etc. in the hope that greenspace is considered an integrative part of the city (Pauliet et al., 2011) and a coherent planning entity Sandström (2002). The EU commission has stated that green infrastructure is a concept addressing the connectivity of ecosystems, their protection and the provision of ecosystem services, while also addressing mitigation and adaptation to climate change. Increasingly within Europe, green infrastructure planning is recognising multi-functionality in the terms of ecosystem services (Pauliet et al., 2011) and this has been promoted as a way of determining the benefits derived from green space and for providing opportunities to improve intensively managed landscapes (Colding, 2011).

Despite the importance of green infrastructure and ecosystem services within urban areas, land-use and management decisions have often failed to take these into consideration. This has resulted in many situations where the services that ecosystems provide to people are becoming threatened or are in danger of being lost entirely (Everard and Moggridge, 2012; Fitzhugh and Richter, 2004; Diamond, 2004). Where this occurs there may be considerable costs associated with both the loss and subsequent restoration required. Some of these costs will be economic, while others may be far more difficult to quantify e.g. the loss of recreational services (Niemela et al., 2010) or psychological impacts on inhabitants.

To date, major efforts have been made to tackle pollution pressures from agricultural/rural environment. However, while water pollution arising from urban areas is estimated to cause up to 10% of all waterbodies to fail their environmental objectives (for example under the Water Framework Directive Classification), it seems that less work has been done to mitigate the impacts of pollution from these (often diffuse) sources. Furthermore, evidence from the range of benefits potentially provided by urban rivers shows that resources invested in the urban environment can provide the greatest return on investment, as this is where most people interact with their environment.

In recent years there has been a significant increase in the efforts being made, across the UK and in other countries, to assess and enhance the ecosystem service benefits and dis-benefits experienced by people in urban landscapes. However, the approaches adopted often vary considerably in the way that benefits are assessed, the types of measures delivered and how and why these measures are targeted into specific sections of the landscape.

## 1.2. Policy & research context

Within the UK, the need to ensure proper consideration of the benefits a healthy natural environment provides in decision-making has been recognised by the 2011 Natural Environment White Paper (UK Government, 2011). This sets out a need for markets, business and Government to better reflect the value of nature within the decision making process. The NEWP sets commitments to fully include the value of natural capital into the UK Accounts by 2020 and to establish The Natural Capital Committee to *'advise the Government on how to ensure England's 'natural wealth' is managed efficiently and sustainably, thereby unlocking opportunities for sustained prosperity and wellbeing'*.

The **Ecosystem Services in Urban Water Environments (Local Action) Project (ESSUWE or LAP)** has provided an important research element supporting key policy areas across Defra's Water Quality policy

areas, most notably the **Urban Diffuse Pollution Strategy**, the **Catchment Based Approach (CaBA)** and the currently emerging **Defra 25-Year Plan**, a recommendation of the Natural Capital Committee. This 25-Year Plan will *'help individuals and organisations at local, regional, national and international levels to understand the economic, social and cultural value of nature, the impact that their actions have on it, and to use this knowledge to make better decisions'*.

The objectives of this project are also aligned with provisions of the **Defra Water Availability & Quality Evidence Plan** to develop research on the value of water and the wide range of products and services it provides, to support a policy framework for water that promotes sustainable, efficient and equitable use.

The Local Action Project has adopted a participatory-research approach to collate, assess and disseminate all of the good-practice and lessons-learned being developed through these different approaches and has sought to develop a consistent framework for the assessment, enhancement and communication/dissemination of ecosystem services benefits in urban landscapes and beyond.

The benefits-assessment framework developed in this study will also enable end-users/stakeholders, with varying levels of prior understanding, to integrate considerations of the trade-offs inherent in land and water management in the decision-making process. This will allow practitioners to develop benefit-based, locally-led catchment management programmes in partnership with local delivery partners to achieve the highest possible environmental and social outcomes. Indeed, this research will be used specifically to ensure the approach and tools developed meet users' needs in urban settings – to stimulate local initiatives to improve the quality of the local water environment with corresponding improvements in wellbeing and livelihood (social and economic).

Additional important components of the assessment framework developed have included: 1) the adaptation of the **Ecosystem Services (ESS) Visualisation** approach already employed by many **Catchment-Based Approach (CaBA)** Partnership Hosts (such as Rivers Trusts and Wildlife Trusts) to be more specifically useful for application in urban landscapes, and 2) the development of an intervention-based cost-benefit assessment methodology for assessing the enhancement of ecosystem service benefits provision in urban landscapes (supported by the EA Economics Team).

Both of these outputs have been developed collaboratively to support urban catchment management initiatives, and to engage and empower CaBA partnerships attempting to work in urban landscapes. In addition, the project is also designed to be complimentary to the larger-scale natural capital research projects currently underway by providing a vehicle for the translation and dissemination of their findings down to local practitioners, decision-makers and community groups (to whom responsibility for delivering measures on-the-ground is increasingly being devolved).

### 1.3. Ecosystem Services Approach

First adopted by the Convention on Biological Diversity (Rio Earth Summit, 2000), the 'ecosystem approach' is a clearly defined strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Humans have developed many and varied geographic units to manage society, such as parish, borough and county boundaries. However, while these units may be the most appropriate for managing people, there is now an increasing recognition that we actually need to manage people within the context of their environment.

River catchments offer a natural management unit (a hydrological ecosystem) where water moves over and through the landscape to the sea via streams and rivers. The ecosystem approach therefore provides an excellent framework for the catchment partnership approach to landscape-scale integrated catchment management planning. The ecosystem services framework sits within the ecosystems approach and it seeks to identify the mechanisms via which the natural environment provides benefits to society and requires that the beneficiaries of these services are engaged in making decisions about the objectives and priorities for their environment (see Figure 4 below).

The quality and quantity of the water in a river is highly dependent on the way we are using the land across the catchment and the variety of services we are deriving from it. Unfortunately, over the last 100 years our

catchment ecosystems and the services they provide have come under increasing pressure from conversion of natural habitats, pollution of land and water, exploitation of terrestrial and freshwater resources, invasive species and climate change. The result is that the provision of the ecosystem services we depend on has been skewed in favour of the production of food, fibre and fuel to the detriment of many of the other services.

In their guidance on the assessment of ecosystem services, the Environment Agency recognises that an ecosystem services assessment can support the identification and selection management options, and help ensure the delivery of optimal outcomes for all people affected by proposed interventions (Environment Agency, 2014). They also identify that stakeholder involvement throughout the process is a key aspect of the framework and that the systematic, iterative and transparent nature of a participatory ecosystem services assessment can provide a means to reach a consensus on the chosen course of action.

Figure 4. The provision of ecosystem services from different sections of a catchment landscape. Efforts have focused on identifying and quantifying the sources of these services, identifying the beneficiaries and quantifying the benefits experienced to inform and target actions designed to enhance provision.



### 1.4. The Catchment Based Approach

In recent years, a substantial body of research has been undertaken to review the 'natural capital' or 'environmental infrastructure' that we have in our various landscapes and to estimate the social, cultural,

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environmental and economic benefits that these assets (or features) provide to both the people who live near them and to society as a whole (at a regional-, national- or global-scale).

The scientific evidence gathered through this research has become an extremely powerful resource to support policy-makers, environmental organisations and planners as they have developed their approaches to land management, environmental protection and ecosystem enhancement at a national-scale. Furthermore, this improved understanding of the 'value of nature' has helped us to quantify and therefore better communicate its importance to our society and this has, in turn, empowered environmental practitioners seeking to win support for their continuing efforts in this field.

Having said this however, for any individuals or organisations interested in delivering practical measures 'on-the-ground' that are targeted and designed to enhance the value of natural capital in urban landscapes at a local-scale (and which therefore also increase the benefits experienced by people living in them), this high-level, coarse spatial scale evidence has not always been found to be as useful.

Experience in a number of towns and cities has shown that community-led partnerships that bring people together with environmental professionals and other interest groups, can generate projects and deliver real benefits for the people living and working there (Benson et al., 2012; Smith et al., 2011; Smith et al., 2015; Cook et al., 2016).

However, experience also shows us that, without the support of local planning authorities, government agencies, developers, policy-makers and, perhaps most importantly, the actual beneficiaries in the 'receiving' communities, it can be very difficult to secure the funding and permission required to proceed with the practical delivery of environmental measures in either rural or urban landscapes. Ultimately, to see their interventions delivered, they have to persuade a number of key audiences (including the local planning authority, policy-makers, funders and stakeholders in the community) that their proposed interventions will be delivered in a cost-effective manner and will generate the primary and secondary outcomes for all of the stakeholders predicted (or required) to benefit.

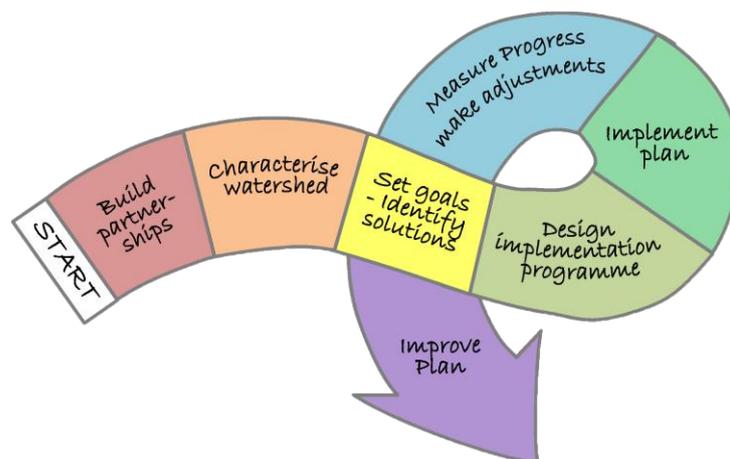
The **Catchment Based Approach (CaBA)** embeds collaborative working at a river catchment scale to deliver cross cutting improvements to our water environments. Community partnerships, bringing local knowledge and expertise, are active in each of the 100+ Water Framework Directive catchments across England, including those cross border with Wales.

Evaluation of CaBA has revealed that partnerships can act as a single point of coordination in a catchment, integrating an otherwise piecemeal approach to land and water management (Smith & Porter, 2010). CaBA has forged a holistic, integrated an evidence-led approach, which promotes the identification of synergies and generates projects which deliver multiple benefits – e.g. flood risk management, improved habitats, connectivity for wildlife, cleaner raw water for water companies, improved angling and recreational opportunities, better soil management, water supply for agriculture.

Catchment partnerships in the UK have adopted the 'integrated catchment management cycle' produced originally by the USDA (Figure 5). This is a participatory, iterative and integrated approach to catchment management planning and delivery and it has also become the key foundation for the Local Action Project described here.

*Figure 5. The CaBA Integrated Catchment Management Cycle (adapted from the USDA).*

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CaBA has been a catalyst for actions that would not have happened without partnerships' involvement. Pursuing multiple objectives through integrated action makes solutions affordable that would have been unaffordable if pursued in isolation. CaBA also has huge value to the Defra family as an exemplar of an integrated approach to catchment management and an advocate and driver for integration. It provides a forum at catchment scale that helps statutory bodies engage with stakeholders and in turn helps find smart ways to deliver environmental objectives. The independent evaluation has revealed that partnerships have generated £4 of benefit in-kind for every £1 of central funding given by Defra.

You can read more about Defra's Policy Framework behind the Catchment Based Approach at [goo.gl/3jOEvv](http://goo.gl/3jOEvv) and find out about CaBA partnerships across the country at [www.catchmentbasedapproach.org](http://www.catchmentbasedapproach.org).

### 1.4.1. The 'knowledge broker' role in the partnership approach

A number of studies have now demonstrated the significant additional benefits to be gained by adopting a participatory ecosystem services approach to environmental planning (especially for water environments) (Pahl-Wostl, 2002; Pahl-Wostl, 2007; Chan et al., 2012; Braken et al., 2014; Kenter et al., 2014). In particular, it has been demonstrated that stakeholders (including the public) are generally supportive of the holistic ambitions and interconnected perspective of the ecosystems approach (Fish & Saratsi, 2015).

Furthermore, the ecosystem services concept has been shown to support: 1) the development of a common language for describing the benefits provided; 2) stakeholders seeking to gain a better sense of the likely synergies and trade-offs resulting from the interventions delivered; 3) communication to stakeholders about the benefits of policy and project goals in a way that inspires engagement and the development of a shared vision/ambition; 4) the acquisition of funding from a diversity of sources for delivery of interventions and 5) robust and evidence-led decision-making (Rall et al., 2015; Braken et al., 2014; Kenter et al., 2014)

The BiodivERsA Handbook (2014) states that stakeholder engagement can provide a number of benefits for researchers, the stakeholders themselves and wider society, including: increased empowerment; improved links and partnerships; access to additional resources or information; endorsement for an approach or decision; better communication, awareness, trust and support, and improved learning through sharing of experiences. In addition, they state that engagement can assist in managing risks and reducing conflict by identifying barriers, limitations and potential negative outcomes before they occur.

Numerous studies (see [www.watergov.org](http://www.watergov.org)) have now shown that undertaking a stakeholder-led participatory systematic review of data and evidence relating to a catchment landscape, when facilitated by an impartial 'knowledge broker', can help to achieve a number of critical outcomes in the catchment planning process (see Figure 6 below):

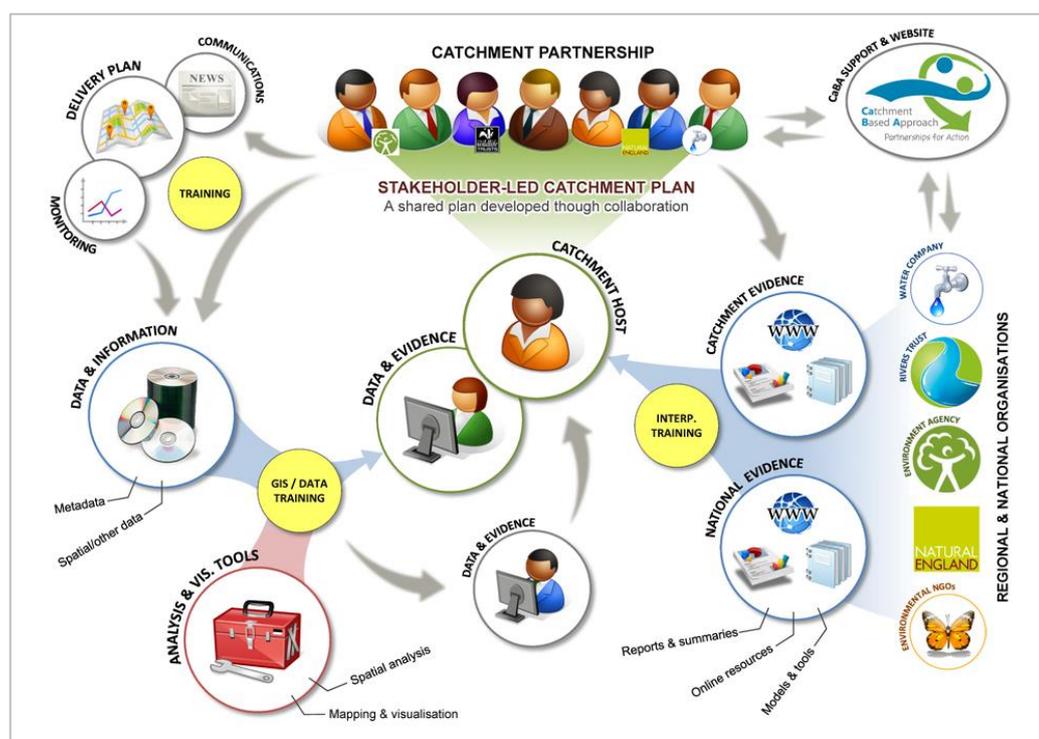
1. It allows the stakeholders, who are invariably from a variety of backgrounds and who initially have highly diverse levels of technical knowledge, to develop a shared conceptual understanding of the issues that may be affecting their catchment and of where the priority and opportunity areas for the delivery of catchment management interventions may occur. Through an inclusive, participatory examination of the data and

## Defra - Local Action Project

evidence all stakeholders are engaged in the process and all can feel that their contributions are valued and have been considered.

- The process also allows the stakeholders in the catchment partnership to develop a shared language with which they can discuss the problems in the catchment, where they are occurring and how they may best be overcome. The data and evidence is used to stimulate and facilitate the discussion and to help stakeholders visualise spatially the pressures and opportunities across their catchment.
- A full review of the environmental data and evidence available for the catchment includes the evaluations of what interventions are already being delivered in the catchment, how they are funded and where there may be deficiencies in this provision that is compromising the enhancement of ecosystem service provision. The evidence review process facilitates the targeting, planning and delivery of catchment management interventions in the most integrated, balanced and cost-effective manner.

Figure 6. Graphic showing the key role of the data and evidence specialist facilitator or 'knowledge broker' in supporting CaBA host organisations through the collation, integration and translation/communication of evidence into information as they undertake collaborative action planning with their catchment partnership.



### 1.4.2. The CaBA Urban-, Benefits- and Data-Working Groups

It was stipulated by Defra that this study should be carried out under the auspices of the CaBA 'Urban Catchment Group' and a new CaBA sub-group the 'Benefits Assessment Advisory Group' – which the project team were asked to convene.

The objectives of the Local Action Project and the Terms of Reference of the CaBA Urban Working Group (see box below) are intentionally well aligned. By integrating the project with these groups the project would be able to draw upon the experience of some of the most successful and promising urban water community schemes already in existence, and work with leading practitioners and local groups to identify and support good practice in urban water stewardship.

In addition, the CaBA Urban Working Group also provides the perfect mechanism for the knowledge exchange, capacity building and dissemination of the project outputs throughout the CaBA Community and urban catchment management 'community of practice'.

### **CaBA Urban Working Group – Terms of Reference**

- 1) Champion the (sub-) catchment partnership approach to water management in urban areas;
- 2) Support CaBA partnerships nationwide by helping them to build capacity, expertise and engage more effectively with key stakeholders, including local authorities, communities, businesses and developers, on urban water management issues in order to enhance collaborative project delivery on the ground;
- 3) Promote the benefits of partnership working in the urban environment, targeting key stakeholders and undertaking a programme of engagement and awareness raising, to include: -
  - i. Collating and disseminating best practice case studies through workshops, presentations, websites, flyers, videos etc;
  - ii. Encouraging dialogue both with and between key stakeholders including planners, flood authorities and water companies;
  - iii. Gathering evidence to showcase the cost effectiveness of partnership working;
- 4) Work with the National CaBA Support Group (NCSG) to jointly develop and deliver on recommendations for CaBA partnership engagement in urban water management, highlighting key barriers and opportunities;
- 5) Facilitate funding provision to strengthen CABA work on urban water management by helping to build organisational capacity - organising workshops, showcasing best practice, producing an urban funding guide and publicising opportunities;
- 6) Investigate the potential to secure national or international funding to support the work of the group;

In addition to the work of the CaBA Urban and Benefits Assessment Working Groups, the Local Action Project has been expedited significantly by the work of the CaBA Catchment Data User Group (CDUG), which has played a critical role in helping civil society groups and catchment partnerships gaining access to a huge volume of geospatial datasets and evidence in recent years. The CDUG has also played an important role in the delivery of the Defra Open Data Initiative.

Without this vital work to open up civil society access to this data and evidence, it would not be possible to develop a universally applicable framework for the assessment of ecosystem services benefit provision or to support robust local decision-making on the protection and enhancement of natural capital in urban landscapes in the way that we have. Having said this, there are number of data access issues that remain to be overcome and the lessons learnt through the Local Action Project will continue to apply pressure to these intractable issues via the Catchment Data User Group and the work of other project partners (e.g. Alex Collins – NERC Research Fellow for Defra and Imperial College).

### 1.5. Aims & objectives

The overarching aims of the Local Action project were to help urban practitioners and local civil society groups to move from the current, opportunistic, single-benefit approach that is evident in many community urban waterways schemes, to adopting a broader framework that:

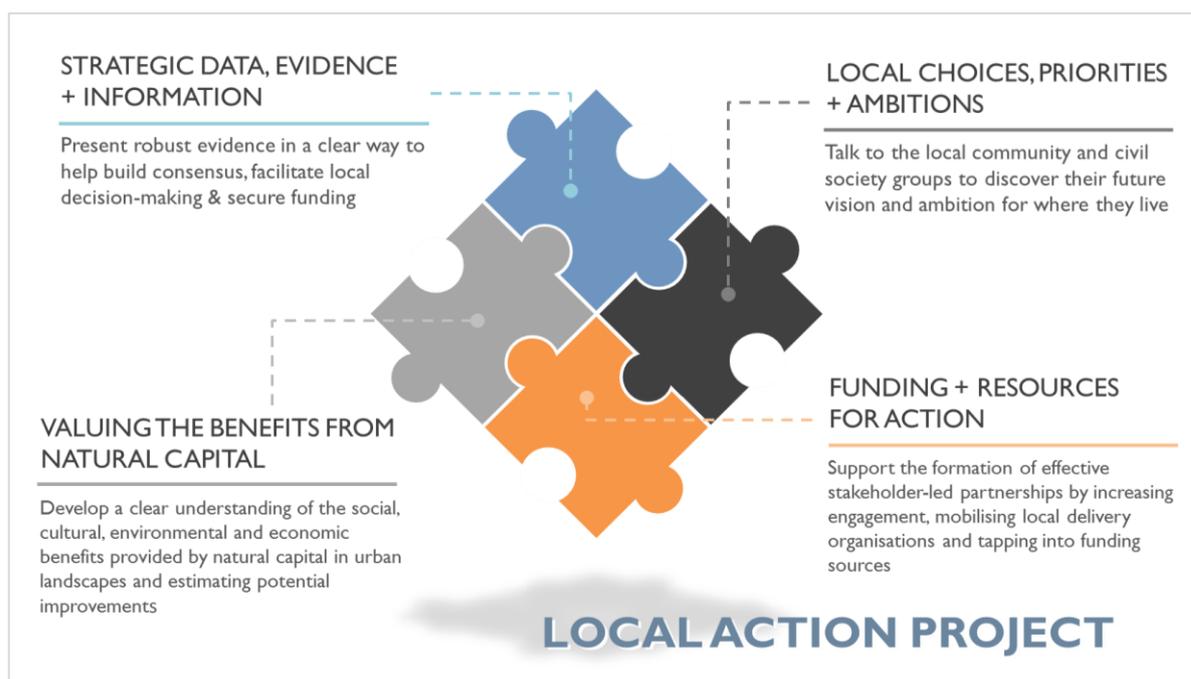
- Includes consideration of a wider range of ecosystem services benefits;
- Develops a common, clear means of illustrating and describing ecosystem services benefits;
- Incorporates better accounting and representation of cost and benefits;
- Provides a representation of the trade-offs in ecosystem services benefits associated with different management options; and
- Enables transparency in decision making especially around costs and benefits

All these aspects of the framework (Figure 7) will help to facilitate more impactful participatory decisions and plans, within a more holistic framework that addresses the preferences of urban communities whilst also helping to inform the Defra **25-Year Environment Plan**.

The activities and tangible outputs of the Local Action Project are summarised below and explored in detail in the following section of this report. Activities undertaken during the project included:

- 1) Characterisation and engagement of the urban catchment management 'community of practice';
- 2) Participatory research with the urban catchment management 'community of practice' to explore challenges and opportunities for delivery of actions;
- 3) Creation of an intervention-based cost-benefit assessment approach (a 'toolbox') for urban practitioners;
- 4) Development of a strategic geospatial mapping framework for participatory ecosystem services benefits visualisation in urban landscapes;
- 5) Iterative, participatory piloting of the ecosystem services benefits visualisation/opportunity mapping approach in four Demonstration Areas
- 6) Participatory research with catchment stakeholders and civil society groups in urban areas to examine their understanding of ecosystem service benefits and natural capital in urban landscapes, and
- 7) Knowledge transfer throughout the urban catchment management 'community of practice' and beyond.

Figure 7. The main elements of the Local Action Project approach



Specifically, the **five** main tangible outputs (over and above the engagement, research, dissemination and reporting activities undertaken) from the project are listed below. These will take the form of evidence, engagement and information resources presented specifically for use by the end-users in the Demonstration Areas and throughout the urban catchment management and CaBA 'community of practice'. These resources will be disseminated primarily through the CaBA Urban Working Group (described previously) for the benefit of all CaBA Partnerships who wish to adopt the process.



### **Review of environmental assets & natural capital value**

A comprehensive review of the environmental infrastructure (identifiable natural features in the landscape) that play a role in the provision of benefits to people living in the urban landscape. Once identified, the magnitude and diversity of the benefits that these natural assets provide have been characterised (and where possible quantified and/or monetised).



### **Strategic assessment of benefits (need, want, priority)**

Assessment of 12 ecosystem services benefits indicators to support strategic targeting of actions. This strategic assessment, when combined with information on statutory regulations, policies or other priorities and drivers, indicates where there may be the greatest need (or opportunity) for interventions to be delivered to realise benefits.



### **Urban practitioners 'toolbox'**

Development of a well-characterised list (or 'toolbox') of interventions that can be delivered by urban practitioners; including feasibility criteria for delivery, the 'needs' each intervention has the potential to address, the likely cost and the diversity and magnitude of the benefits likely to be realised. To include a comprehensive set of 'best practice' case studies.



### **Detailed opportunity mapping**

Detailed analysis to identify opportunity areas for the delivery of urban interventions. Based on the feasibility criteria for each intervention, the 'needs' assessment and target areas where priorities and drivers coincide, the capacity of the landscape to receive a suite of interventions can be determined and used to develop cost-benefit-assessed intervention scenarios.



### **Knowledge transfer & capacity building**

All of the technical evidence developed will be 'translated' into a series of engaging and effective communication/education/engagement tools for knowledge transfer to and to facilitate the empowerment of a wide array of audiences no matter what their level of prior knowledge (policy makers, practitioners, catchment hosts/partners, wider stakeholders, local community).

## 2. APPROACH & OUTPUTS

A review of the work currently being done to enhance the provision of environmental benefits in urban landscapes has revealed that, while there are many examples of great practice from around the UK, there are also very many locations where local decision-makers and practitioners do not have access to vital evidence and information (CaBA, 2016). As a result of this lack of evidence and information, these groups therefore often struggle to engage with stakeholders and cannot develop a shared vision for the future of their landscape, build consensus on what actions are required or convince funders to invest. The result of this, is that often high value multi-functional interventions that increase ecosystem services benefits and natural capital value of the urban landscape are not realised.

To meet this shortfall, Defra established this Ecosystem Services in Urban Water Environments (Local Action) Research Project, which has explored how local knowledge brokers or environmental practitioners can develop these evidence and communications resources and use them to support the planning, funding and delivery of targeted environmental projects that deliver economic improvements and enhance health and wellbeing in their area.

During the project, work has been undertaken improve the types of tools and techniques available to catchment partnership and practitioner groups by:

- Examining the full range of benefits that can be delivered through environmental work and, in particular, those linked to health, wellbeing and welfare;
- Co-designing tools and approaches that are consistent and rigorous so that benefit cases are robust in the context of the full range of potential funding sources available to support projects, and;
- Developing ways of describing and linking ecosystem services and natural capital in ways that are relevant to non-specialists.

The last of these aims is directed towards language and framing of benefit and gain in ways that resonate with the local community and which can both deepen levels of engagement while also widening the potential range of actors and partners involved.

Urban environments are considered a particularly suitable test-bed for the application of an ecosystem services framework, because of the diversity in both community groups and the agencies involved in providing services to them. All need to be aligned to achieve coherent management of the water environment to the benefit of all. Having said this, the lessons learned and tools produced during these studies should also be applicable to any landscape (although this suitability/utility still needs to be assessed).

The principal components of this project are described in the sections following below.

### 2.1. Characterisation & engagement of the urban ‘community of practice’

Throughout this project a variety of approaches have been adopted to engage with and review the work of the urban catchment management ‘community of practice’. From the outset, there was a clear need for careful and full engagement with a broad representation of key stakeholders (technical and non-technical) both to elicit information and to disseminate it.

This engagement has been achieved by: holding a series of specifically organised workshops; attending the CaBA Urban, Benefits Assessment and Data sub-groups, and via many face-to-face meetings with specialists from across the urban ecosystems services/green infrastructure/urban regeneration & land management/sustainable drainage sectors.

This engagement strategy has enabled us to undertake a comprehensive review of the current best practice in urban catchment management required. It has also been important for the project team to ensure that the engagement is tailored to suit each specific group and the potential usefulness of this project is conveyed effectively to ensure that their ‘buy-in’ to the project is achieved.

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The table below (Table 1) gives some examples of the types of organisation that have been engaged in the process and this formed a starting point upon which a full stakeholder mapping exercise could be undertaken. The full list of contacts and stakeholders engaged during this project is provided as an additional resource to supplement this report.

Table 1. Examples of practitioners/groups with case studies who have been engaged during the Local Action Project...

CaBA/Delivery Orgs	Government Sector	Water Industry	Academia (Centres)
– Urban Forest Groups	– Defra	– South West Water	– Sheffield University
– CaBA National Support	– Local Authorities	– Thames Water	– University of Exeter
– Rivers Trusts	– Environment Agency	– Wessex Water	– Imperial College
– Wildlife Trusts	– Natural England	– Severn Trent Water	– Birmingham University
– WWT	– Forestry Commission	– Scottish Water	– British Geological Survey
– RSPB	– NRW	– UKWIR	– Open University
– Canal & Rivers Trust		– CIWEM	– University of Durham
– Groundwork			

Business	Specialists/Consultants	Economics/CBA Experts	Urban Projects
– Developers (?)	– Ciria/Susdrain	– EA Economics Team	– Blue-Green Cities
– Landscape architects	– Robert Bray Associates	– Valuing Nature Network	– Urban Demonstrators
– Food producers/ processors	– AECOM	– Natural Capital Committee	– Love Your River Telford
– Recreation/leisure	– Arup	– Uni of East Anglia	
– Drainage/highways	– Peter Bide	– Ecosystem Knowledge Network	
	– Town & Country		
	– Institute of Environmental Analytics		

### Pre-Project Workshop: Practical Developments in the Ecosystem Service Approach and Catchment Management - A Workshop to Support Emerging Good Practice in Towns and Cities

In December 2014, Defra hosted a 1-day workshop examining the application of the ecosystem services approach catchment management in urban landscapes. The workshop focused on the showcasing of good practice from around the urban practitioner 'community of practice' and discussing the potential to share experiences and aspirations, to identify barriers to the enhancement of urban environments that need to be addressed and to inform future R&D work into this subject.

A summary of the notes from this workshop are included in Appendix 2 of this report.

### Conference & Workshop: Delivering Environmental Benefits for Urban Communities

On the 22nd October 2015, around 85 environmental practitioners, catchment partnership hosts, strategic planners and academics attended the **Delivering Environmental Benefits for Urban Communities Conference & Workshop** at the Priory Rooms in Birmingham.

The event, which was convened under the auspices of the Catchment Based Approach Urban Working Group, and organised by the Defra Urban Ecosystem Services Project (Defra, Joint Water Evidence Group – JWEG, and the Westcountry Rivers Trust) and Ciria/Susdrain, was designed to support the objectives of the Urban CaBA Sub-Group.

The morning session of the Conference was run as a 'show and tell' symposium designed to meet the objectives of the Urban CaBA Sub-Group: 1) **champion the Catchment Partnership approach** to water

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management in urban areas; 2) **support CaBA partnerships nationwide** by helping them to build capacity, expertise and engage more effectively with stakeholders, communities, developers, funders and businesses, and 3) **promote the benefits and raise awareness** of partnership working in the urban environment. During this session practitioners, strategic planners and academics were given 5 minute slots to introduce their work/expertise and to signpost people to their resources or further information.

These 'pitches' were divided into: 1) **practical delivery of interventions**; 2) **strategic tools/approaches** (incl. CBA, targeting, design/optionseering); 3) **help and guidance for urban practitioners**, and 4) **engagement, communications and partnership working**. Speakers were invited to say what they have done, what their objectives were and what the outcome of the work was/is intended to be.

Delegates and speakers were also invited to bring posters, case studies or other resources to show at the event (irrespective of whether they got to speak).

In the afternoon there was a facilitated carousel workshop designed to develop people's understanding of the current ways of working (good practice), to get people thinking about these issues in a more structured way and to refine our approach to creating resources that empower and facilitate the work of catchment partnerships in urban areas.

The topics under discussion were: 1) **strategic targeting and design of interventions**; 2) **the urban practitioner's toolbox**; 3) **partnership working, stakeholder engagement and communications**; 4) **community mobilisation and sources of funding**; 5) **assessment and communication of benefits**, and 6) **barriers to delivery and knowledge gaps**.

In addition to getting involved in the programmed activities, everybody who came to the event was also asked to make an offer (or offers) to the other delegates and to the urban practitioner- and catchment partnership-communities more widely. It didn't matter what it was – it could have been time, help, training, case studies, resources, information, mentoring, data or evidence, but we really wanted them to make an offer.

In return, everybody was also encouraged to tell us what things they feel they are lacking or what they feel they might need that would help them move forward in their work in urban environments/landscapes. The idea was that we would then try to connect people who have complimentary offers and needs together.

Figure 8. The Delivering Environmental Benefits for Urban Communities Conference & Workshop in Birmingham, October 2015.



### Conference & Workshop: Green Infrastructure & Urban Water Management Workshop

In March 2016, the CaBA Urban Working Group (funded by the Defra Urban Demonstrators Initiative), in collaboration with the Defra Urban Ecosystem Services Project ([www.urbanwater-eco.services](http://www.urbanwater-eco.services)) and Ciria ([www.ciria.org](http://www.ciria.org)), hosted a series of workshops designed to build capacity and expertise within CaBA partnerships to help drive greater collaborative delivery within the urban environment.

The first of these workshops (programme included in Appendix 3), which held was in Exeter on the 16<sup>th</sup> March, was attended by 85 delegates from a variety of backgrounds. Topics covered at this event included;

- A showcase of experiences and learning from across the South West
- Masterclasses from key experts demonstrating exemplar work from around the country
- Defra urban ecosystem services, cost-benefits assessment & natural capital valuation work
- Key datasets, spatial evidence and strategic targeting/design approaches
- Assessment of outcomes, monitoring and securing long-term sustainability
- Breaking down the barriers to the delivery of exemplar SuDS and GI in the South West
- Governance, roles and responsibilities across key stakeholders: potential opportunities for collaboration & funding

Figure 9. The CaBA Green Infrastructure & Urban Water Management Workshop in Exeter, March 2016.



### 2.2. Participatory research with the urban catchment management 'community of practice'

It is clear that the delivery of environmental enhancement in urban landscapes is conceptualised and described in a wide array of different ways depending on which organisation or group is responsible and the nature of their own ethos and objectives. This added complexity made the collation and review of 'best practice' and 'lesson learnt' in this area more challenging and it was, therefore, critical that a number of key questions were answered for each case study examined.

Standardising the information captured during this process ensured that all of the case studies (no matter which groups have undertaken them) could be appraised, translated and integrated into a consistent and robust ecosystem services assessment framework later in the project.

Participatory research with the urban catchment management 'community of practice' was undertaken using a practitioner questionnaire in combination with a series of meetings, workshops and interviews.

The main topics under examination were: 1) **strategic targeting and design of interventions**; 2) **the urban practitioner's 'toolbox' of interventions**; 3) **partnership working, stakeholder engagement and communications**; 4) **community mobilisation and sources of funding**; 5) **assessment and communication of benefits**, and 6) **barriers to delivery and knowledge gaps**.

The full questionnaire used as the structure for this study is included in Appendix I.

#### *Research findings – barriers & knowledge gaps*

From the various workshops, meetings and questionnaires undertaken for the project, we have been able to characterise the key barriers and knowledge gaps that currently act to prevent the delivery of green infrastructure, SuDS and green-blue regeneration of urban landscapes.

Our findings, which are summarised below (Figure 10) and are currently being prepared for publication, are entirely in accordance with the previous findings of Bide (2014) and others (e.g. Thorne et al., 2015), who found that there are multiple barriers and challenges to GI and SuDS delivery in urban landscapes. In particular, there is a perception that the costs and benefits of GI and SuDS are poorly understood and communicated, that more collaboration and integration of actions is required, and that better information, engagement and support is needed. What this research has highlighted is the importance of developing the right language and using it to enhance the collaborative, deliberative and engagement activities of practitioners and brokers.

*Figure 10. Word cloud analysis of the Barriers & Knowledge Gaps Workshop in Birmingham – October 2015.*



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### 2.3. An intervention-based cost-benefit assessment framework for urban practitioners

As part of the Local Action Project, a framework for the assessment of costs and benefits of catchment management programmes in urban landscapes has been developed. Building on the significant experience of the EA Economics Team and in consultation with the newly established CaBA 'Benefit Assessment Task & Finish Group', we have used the information gathered in the preliminary studies to develop a framework for the quantification of benefits resulting from interventions designed to enhance ecosystem service provision or mitigate loss of provision in urban landscapes.

This framework will be scalable, to ensure that it can be applied to a broad spectrum of urban situations, and include a widely applicable series of metrics that allow all potential benefits to be measured (whether monetisable value or not).

#### General Approach

The list of interventions was compiled by reviewing existing typologies of green infrastructure components and sustainable drainage systems. They were categorised into 'existing assets' and 'interventions' based on the likelihood of being implemented as a new feature.

Parks, allotments, urban rivers/watercourses and private gardens were classed as 'existing natural assets' that it is very difficult to create *de novo*. As such assets it is important to understand their structure and distribution and to examine the functions and therefore benefits they provide and to whom. This is important because these assets often under pressure from various factors, for example new development, high demand and deterioration of quality or amenity value. While their size or number may be increased in some cases, it is more often the case that existing ones have to be protected (see for example Smith, 2010; Heritage Lottery Fund, 2014). Throughout the process of collating information, the list of interventions was modified in order to allow for interventions with similar features to be treated together, making the toolbox more manageable and easier to use.

Information relating to each asset type or intervention was collated from a variety of sources in the grey as well as academic literature. Grey literature was mostly used to provide initial information and signposting to

academic publications, but also as a source in its own right, especially where it was published by accredited organisations such as Forest Research or the Environment Agency. A semi-structured literature review using the snowball method (REF) was carried out to gain a broad range of information on each intervention respectively. Especially information on costs and maintenance was taken mainly from grey literature, as this is not a topic academic publications are usually concerned with.

Additionally, the Natural England Ecosystem Services Transfer Toolkit and the SuDS Manual (Kellagher et al., 2015) was used to provide an overview as well as validation of findings where applicable.

### Benefits ‘Wheels’ Assessment

To allow comparability and consistency throughout the use of the output from the Local Action Project, and to make the use of the toolbox as simple as possible, the same twelve indicators for benefits were used to describe interventions as for the GIS-based needs assessment (see below for full description).

The indicators in the wheel were given a ranking from 1 to 5 based on the ability of an intervention to increase the provision of certain ecosystem services/benefits from ecosystem services in the urban landscape. This describes its ability to increase a benefit compared to other interventions, with 1 signifying “low/unlikely” and 5 signifying “high/very likely”.

Benefit indicators are a semi-quantitative measure that allow comparison between different interventions, but not the quantification of the increase of a benefit or the ability to add benefits together (REF). It does also not allow comparison of benefit indicators within a wheel. For example: this means that an intervention ranked 1 on the benefit indicator “Cultural Activities” and 5 on “Aesthetics” is unlikely to contribute to the provision of opportunities for cultural activities, compared to an intervention that is ranked 5. It does not mean that the intervention contributes 5 times as much to an aesthetically pleasing environment than to providing opportunity for cultural activities.

The rankings are based on the collated literature. The value given to each indicator was based on set of characteristics and their comparison within the different interventions. Literature was identified specific to each intervention, however, where it was likely that findings could be transferrable (e.g. due to similar characteristics in one aspect), and information on a specific intervention was not easily available, evidence that was not specific to the intervention was accepted. For each indicator, a number of sources were used where possible to provide an overall estimate of the performance of the intervention. More weight was given to academic literature reviews and grey literature from accredited sources presenting evidence, but case study evidence and academic papers were used to complement these.

As a measure of confidence, a “traffic light” system was used to indicate the evidence base the ranking was based on. Each of the indicators on each intervention was given an asterisk in red, amber or green, designating a level of certainty: red meaning little availability of and/or high uncertainty within the literature; amber meaning mainly positive evidence in the literature but little literature available or sometimes uncertainty in literature; green meaning that a strong evidence base confirms the positive influence of the intervention.

*Table 2. An overview of each indicator and its characteristics.*

Indicator	Description	Evidence used
<b>Health: Access</b>	potential to provide accessible, attractive green space (either intervention itself or designated area) and the health benefits arising thereof, or to improve accessibility of existing area	Evidence on positive health impacts linked to specific intervention, evidence on use of intervention for physical activity, evidence on potential to provide accessible green spaces, evidence to increased use of greenspaces due to intervention
<b>Health: Air</b>	potential for air quality improvement if used optimally, i.e. wind direction, pollution sources etc. are taken into account	Evidence on pollutant removal of specific or similar intervention, evidence on air quality, evidence on air quality related health benefits

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<b>Flood (Surface)</b>	contribution to reducing surface water flooding through either infiltration, conveyance or storage of runoff. Higher numbers have been assigned to interventions infiltrating runoff, since this reduces the volume of runoff from the start	Evidence on infiltration rates and volume reduction, evidence on peak flow attenuation, evidence on storage. This is a very difficult indicator as surface water flooding can be mitigated in various ways and on various scales. Using a single number to represent this is difficult. Awareness of the detailed description given is therefore important as well as of the causes and symptoms of the surface water flooding situation one is trying to tackle using these interventions.
<b>Flood (Rivers &amp; Sea)</b>	Indicates potential to influence flooding from rivers through providing storage or reducing volume of water the river receives	Evidence on ability to influence flood management and reduction of runoff of intervention itself or similar interventions
<b>Habitat</b>	Indicates the ability to provide habitat for a variety of species (plants & animals) and form part of an urban ecological network	Evidence for species numbers and species rareness found linked to intervention, evidence for habitat value, evidence for use as stepping stones
<b>Low Flow</b>	Indicates potential contribution to groundwater recharge or to reduction of pressure on mains water	Evidence for infiltration and groundwater recharge, evidence for flow regulation, evidence for decreased use of mains water (ultimately reducing abstraction) of intervention itself or similar interventions
<b>Water Quality</b>	Indicates the ability to prevent pollution either through breaking down pollutants or reducing polluted runoff	Evidence for infiltration of polluted runoff (reducing amount of pollutants reaching surface water), evidence on breakdown of pollutants in intervention, evidence of reduced pollutants in runoff
<b>Climate Regulation</b>	Indicates potential to regulate local air temperatures and store/sequester carbon.	Evidence on reducing temperatures, evidence of positive impact on UHI, evidence on carbon sequestration/storage in intervention or similar interventions
<b>Cultural Activities</b>	Indicates likelihood to provide opportunity for engagement in cultural activities and/or experience cultural values	Evidence on cultural values connected to intervention, evidence on activities relating to cultural benefits, evidence on use of intervention as meeting points
<b>Aesthetics</b>	Indicates aesthetic value of intervention itself and contribution to appearance of local area	Evidence on aesthetic value of intervention, evidence on opportunity for design and creation
<b>Property Value</b>	Indicates potential impact on increasing value of property	Evidence on increased property values linked to intervention or similar interventions
<b>Flood Damage</b>	Indicates contribution intervention can make to reducing severity of flooding (both from rivers and surface water) and therefore damage done	Combination of evidence on surface water flooding and fluvial flooding, taking into account the scale on which the intervention works

### Limitations

While the approach taken was similar to a structured literature review, it did not use the same methods of classifying and weighing different sources in a structured way. Due to time constraints, the literature used was limited although a high number of sources were identified and through the use of established sources of grey literature and existing reviews, the overall coverage of evidence should be sufficiently high.

This does mean however that opportunities to showcase the multiple and varied benefits that different features of green infrastructure can provide may have been missed. This is even more likely as green infrastructure is a very broad and fluid concept that is dealt with by the academic community using a number of different disciplines, terminologies and approaches. This makes it challenging to gather all relevant data within a limited amount of time.

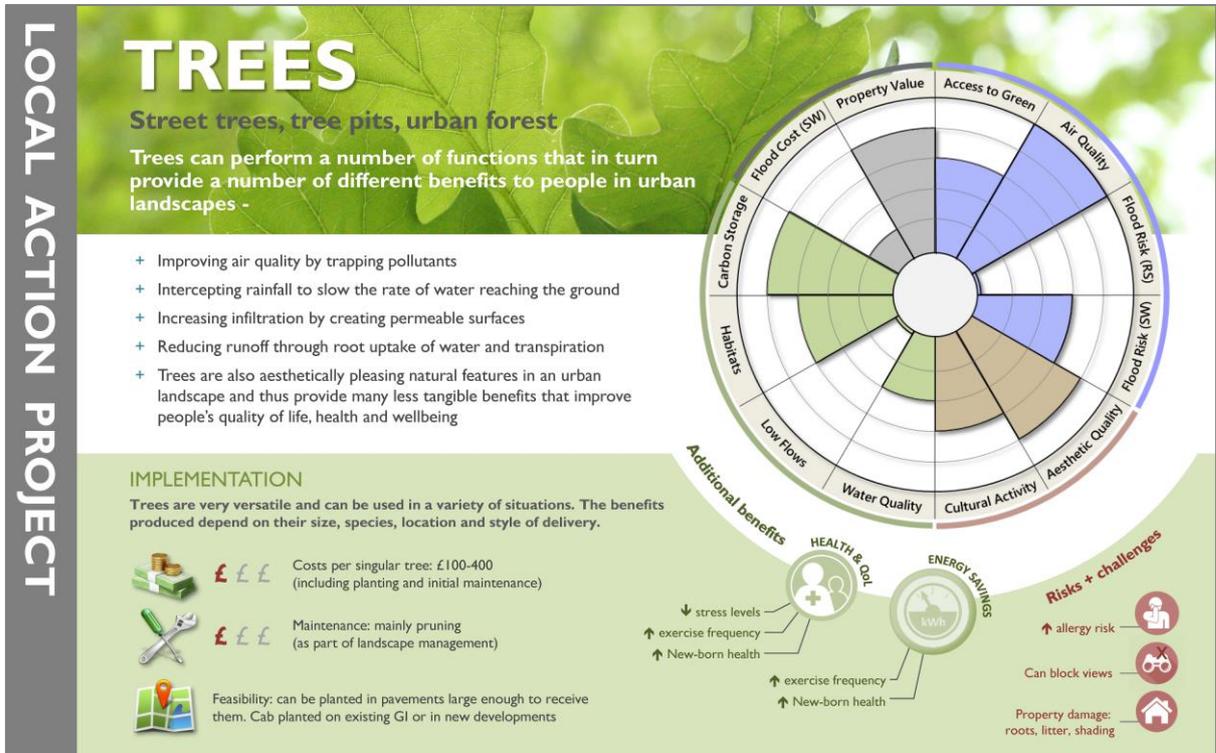
Additionally, while efforts were made to include broader literature and evidence on urban ecosystem services in general and green infrastructure more specifically, the literature search was focussed on identifying benefits that could be linked to specific interventions, potentially missing evidence that was not clearly related to them.

While the semi-quantitative ranking is based on a comparison of evidence, it still has the potential for some bias as evidence was weighed by the researcher, potentially influencing the ranking. To make this evident to the user and to enable further referencing, the confidence indicators were incorporated into the review process and summary factsheets.

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The full Urban Practitioners 'Toolbox' of Interventions developed is presented as a separate supplementary document to this report and all of the intervention factsheets are presented on the project website – <http://urbanwater-eco.services>

Figure 12. An example of an urban practitioners 'toolbox' factsheet presented in an accessible, engaging and informative format



### 2.4. Framework for participatory ecosystem services visualisation in urban landscapes

There are now numerous tools and approaches that have been developed to support ecosystem services-based decision-making in environmental management. Reviews of these various approaches have revealed that the evidence produced can be highly variable and there is huge variability in their requirements for data, their user-friendliness and their accuracy. Most approaches have to make compromises between usability and scientific accuracy, which means that practitioners have to choose which one to use very carefully (Vorstius and Spray, 2015).

In a review to assess existing data, models, and other knowledge-based methods for valuing the effects of sustainable land management, Turner et al. (2016) concluded that, despite there being a huge amount of data and methods currently available to model and analyse land management practices, it is currently very fragmented and requires consolidation and reformatting (translating) in order to be useful. They go on to point out that the current methods and models are not well equipped to handle large-scale transdisciplinary analyses and that there is a need for further development of integrated approaches, which consider all four types of capital (human, built, natural, and social) and their interaction at spatially explicit, multiple scales. They recommend that this could be facilitated by adapting existing models to make them and their outcomes more accessible to stakeholders and therefore useful in supporting participatory decision-making and scenario testing.

This requirement, for the highly complex scientific data and evidence relating to ecosystem service provision and the valuation of benefits to be 'translated' into locally-tailored co-developed 'actionable knowledge', has now been identified by many as a critical next step in the evolution of the ecosystem services approach to environmental management planning going forward (Luederitz et al., 2015; Chan et al., 2012) and nowhere is this need more keenly felt than in urban landscapes.

As a result of these findings, a number of studies have now built on the learning gained from ecosystem services source identification, function/benefit assessment and quantification approaches to develop approaches with more accessible and easy-to-understand outputs. These approaches have been specifically designed to inform collaborative and deliberative strategic targeting of interventions, support robust policy decision-making at a various spatial scales and promote cooperative action to enhance the environment.

Chan et al. (2012) have reminded us that ecosystems produce benefits through services, and those benefits matter to people and decision-making in many ways insufficiently represented by monetary valuation. They argue that the effectiveness of an ecosystem services assessment framework in supporting decision-making is often reduced by: 1) conflation of services, values, and benefits, and 2) a failure to appropriately examine diverse kinds of values. They recommend that this be overcome by: 1) defining multiple types of value, which have implications for appropriate valuation and decision-making; 2) demonstrating the interconnected nature of benefits and services, and so the ubiquity of intangible values; 3) discussing the implications of these propositions for ecosystem-services research with stakeholders; and 4) enable and empower decision-making that is ecologically appropriate and socially just.

In another example, the Matrix Ecosystem Services Supply Model (Jacobs et al., 2015) has been shown to not only provide scientifically sound and politically legitimate results, but also to improve cooperation between natural and social sciences, experts, stakeholders and decision makers. Collaborative development of the model contributed to transdisciplinary ecosystem service research aimed at effective implementation and action.

The Westcountry Rivers Trust, in collaboration with Defra and the Rivers Trust, has previously developed a method for undertaking stakeholder-led spatial visualisation of ecosystem services provisioning areas across a catchment landscape. During this participatory process, stakeholders (1<sup>o</sup>, 2<sup>o</sup> and 3<sup>o</sup>) and technical specialists work with a broker/facilitator to collate and scrutinise all of the data and evidence relating to environmental infrastructure and ecosystem services provision for their area of interest.

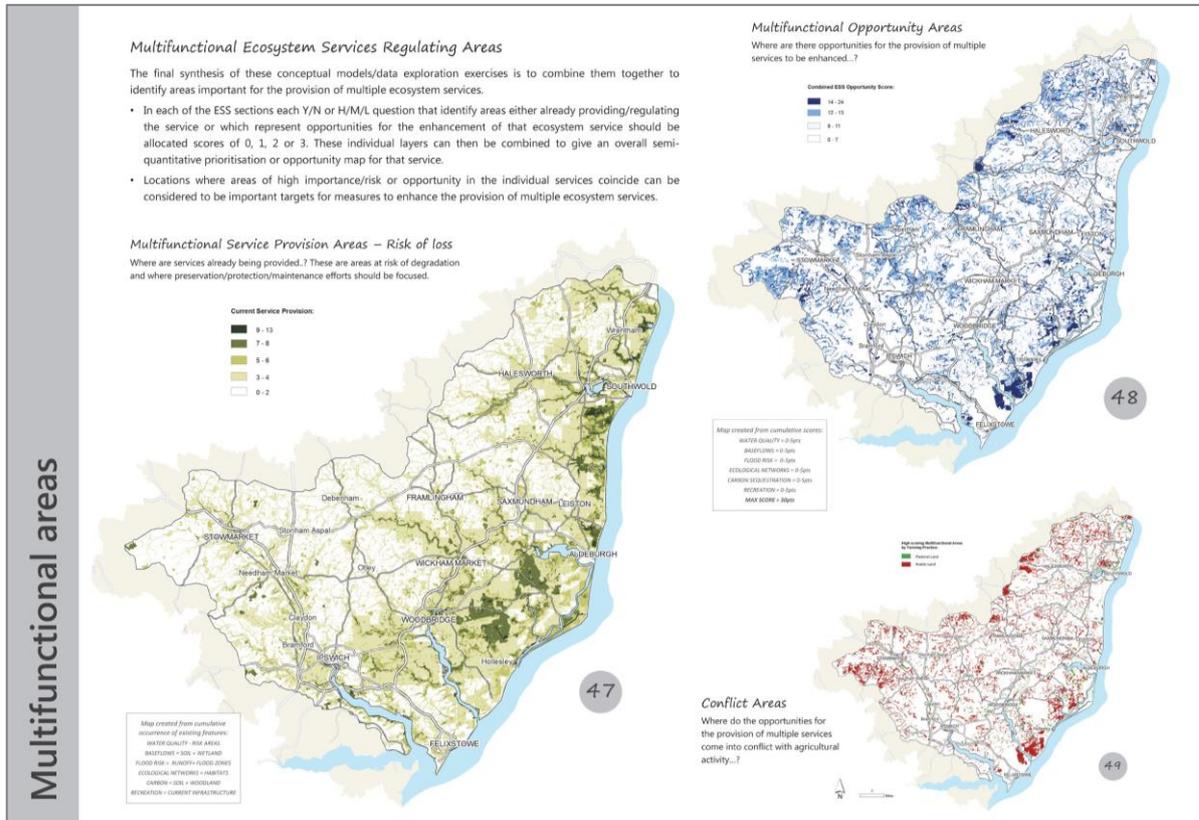
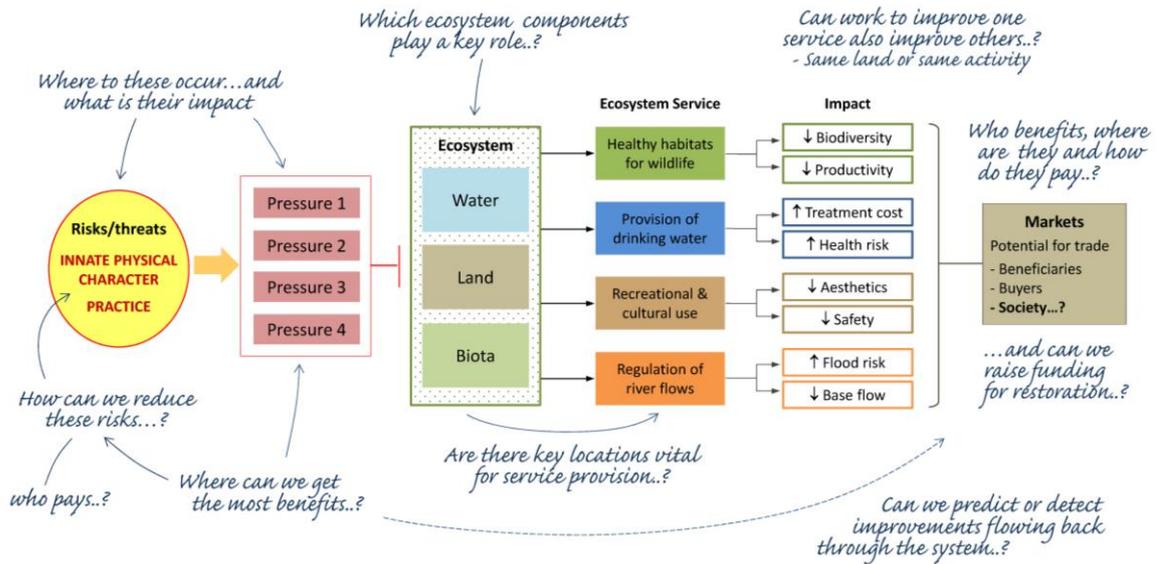
Once the evidence has been evaluated, the partnership then works to define areas of the catchment most likely to play a critical role in the provision of the different ecosystem services singly or in combination. These

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priority areas are locations where a programme of measures may realise the greatest enhancement in the provision of multiple ecosystem services.

Fundamentally this is a data visualisation and evidence exploration process that facilitates the development of a shared vision and a common language in civil-society-led catchment group.

Figure 13. An overview of the WRT ESS Visualisation process developed previously



Building on this previous work, the Local Action Project has aimed to work with local communities and decision-makers to develop tools to support the planning and implementation of environmental improvements that will contribute to improving people’s lives, the environment and economic prosperity within urban areas. If successful, this will contribute not only to meeting requirements of the Natural Environment White Paper and

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Defra's 25-Year Plan but also commitments to encouraging partnership approaches which have been made in recognition that delivering sustained improvements to the environment are best achieved through better understanding of the environment at a local level (Defra, 2013; CaBA, 2016).

The project has worked closely with decision-makers in urban areas in order to allow co-development of the methodology. As described above, the co-development of models and assessments has been shown to be key to ensuring stakeholder buy-in and confidence in tools provided. Furthermore, co-development allows the process to become an iterative, 'learning-by-doing' approach, which was particularly important as developing a method that was easy to use and could communicate to the wide range of audiences who may be involved with decision-making was a primary objective of the project.

Another key objective of this study, was for the approach to be documented as an easy to use manual or 'how to' guide that would enable other organisations to simply and effectively adopt it in their catchments if required.

The aim of the Local Action Project was to provide evidence and information resources that enable and empower local practitioners, civil society groups and catchment partnerships to target and deliver multifunctional and effective interventions in a more cost-beneficial manner. In order to achieve this, the catchment management planning and decision-making processes they are trying to expedite had to be characterised in detail and the evidence and information generated by the project then carefully tailored to facilitate the work of these end-users at every stage of the process they are engaged in.

**Fundamentally the Local Action Project is about language, listening and developing resources that support and empower local practitioners and catchment partnerships to engage, communicate with, educate and persuade a wide array of different audiences (each with different wants/needs, varying prior knowledge and with different visions of what an urban landscape of the future might be like).**

In order to secure the support of these critical and diverse local stakeholders, practitioners must be able to demonstrate that their plans are strategic, targeted, balanced and that they will be delivered in a cost-effective manner.

In particular, they require **FOUR** key sets of detailed additional information (see Figure 14):

- A comprehensive review of the environmental infrastructure (identifiable natural features in the landscape) that play a role in the provision of benefits to people living in the urban landscape. Once identified, the magnitude and diversity of the benefits that these natural assets provide needs to be characterised (and where possible quantified and/or monetised) and the people who benefit identified.
- Evidence that informs and empowers local decision-making by enabling the strategic targeting of measures by demonstrating where there is the greatest need for intervention.

This 'need' or opportunity for enhancing provision of ecosystem services can be defined in a number of ways. For example: 1) they may be areas experiencing a lack of ecosystem service provision (determined by examining the baseline level of provision); 2) where there are statutory requirements for the provision of benefits to be maintained or improved; 3) where other socioeconomic impacts could (at least in part) be mitigated through the enhancement of environmentally-derived benefits, or 4) where there is consensus among local stakeholders that action is required in a particular location.

- A well-defined and understood list (or 'toolbox') of interventions that can realistically be delivered by practitioners operating in a specific urban landscape. For each intervention the practitioner needs to understand the criteria that indicate its feasibility (or opportunity) for delivery and the 'needs' it has the potential to address – this will enable them to identify both target locations for delivery and to quantify the capacity of the landscape to receive any particular intervention.

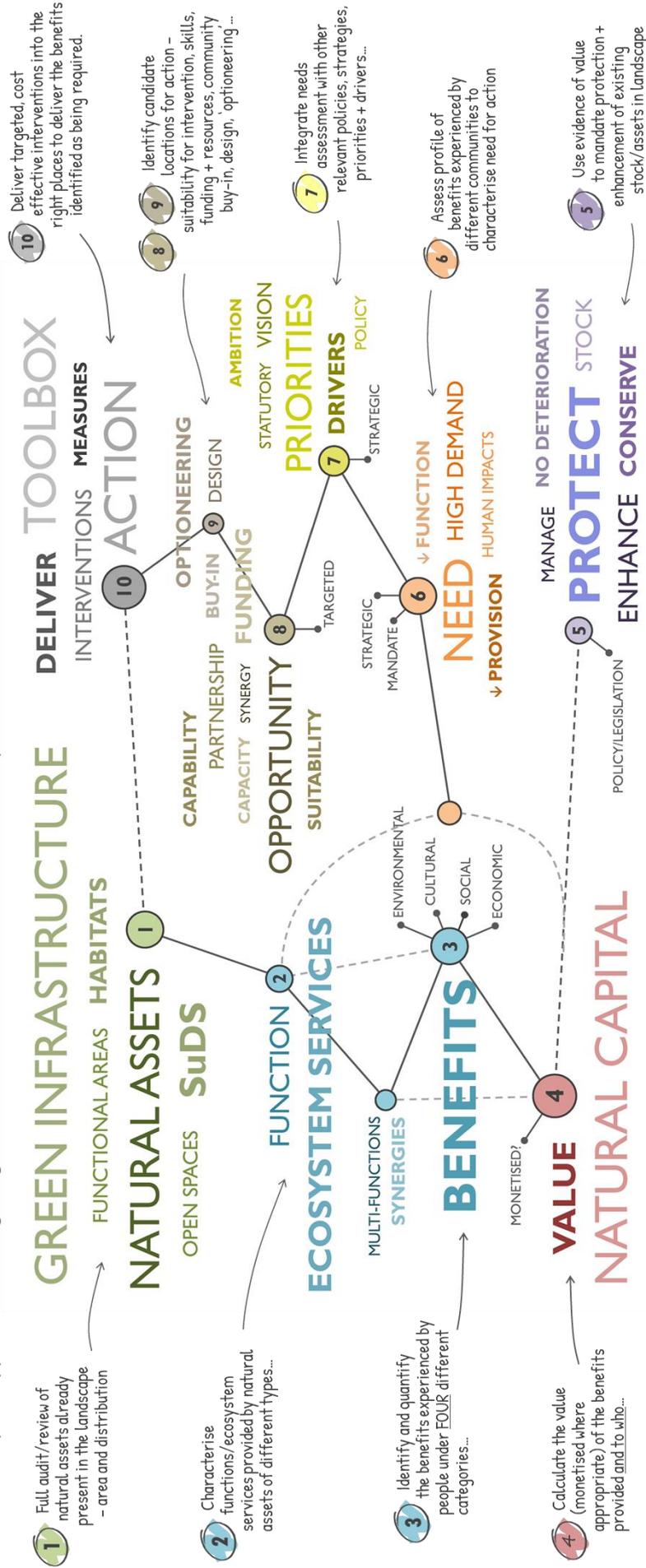
In addition, they also need to understand what each intervention is likely to cost and be able to predict both the diversity and magnitude of the benefits likely to be realised (i.e. its contribution to meeting the identified need) and who is likely to benefit.

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- A comprehensive compendium of engaging and well characterised case studies and research findings which they can use to support the case for action by illustrating the outcomes that have been achieved by other people in similar situations, what these interventions have cost and what lessons were learnt as the work was undertaken.

*Figure 14. Over Page. Summary of the Ecosystem Services assessment process developed during the Local Action Project.*

A natural capital approach for targeting environmental measures in urban landscapes



## 2.4.1. Current provision of ecosystem service benefits – ‘natural capital’

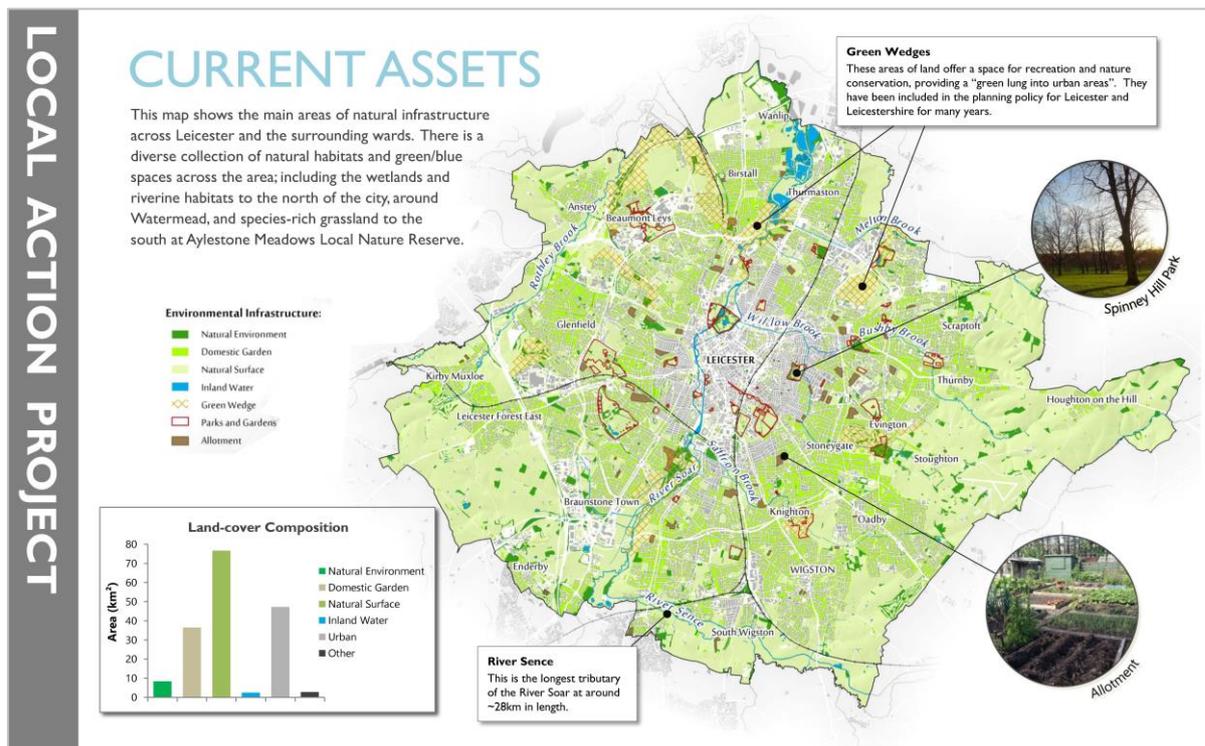
Before a strategic assessment of need or opportunity to deliver environmental enhancement measures can be performed, it is first very important to undertake a comprehensive audit of the environmental infrastructure (natural capital) already in the landscape. Having done this, it is then possible to characterise the ecosystem services these assets currently provide, to identify who the beneficiaries of these services are and to determine what demand there is for these benefits (and hence identify whether some of the ‘assets’ are under pressure and therefore at risk of degradation).

This review process allows assets providing important benefits to be identified and provides evidence in support of efforts to protect and enhance them. In addition, it is vital to characterise the current natural capital in the landscape to ensure that any proposed programme of interventions designed to enhance provision is strategic and correctly targeted.

A critical component of this work, which along with the infrastructure mapping, is required to inform the analysis, was to perform a detailed evidence review of the principal green infrastructure typologies: private gardens, public parks, allotments and urban rivers/waterbodies. These reviews included a comprehensive assessment of: the full costs of managing and maintaining these assets; the diversity and potential magnitude of the benefits provided, and an indication of the spatial scale and the flow of these benefits through the urban landscape.

These reviews can be viewed on the Local Action Project website - [www.urbanwater-eco.services](http://www.urbanwater-eco.services)

Figure 15. Example map showing current natural assets in an urban landscape



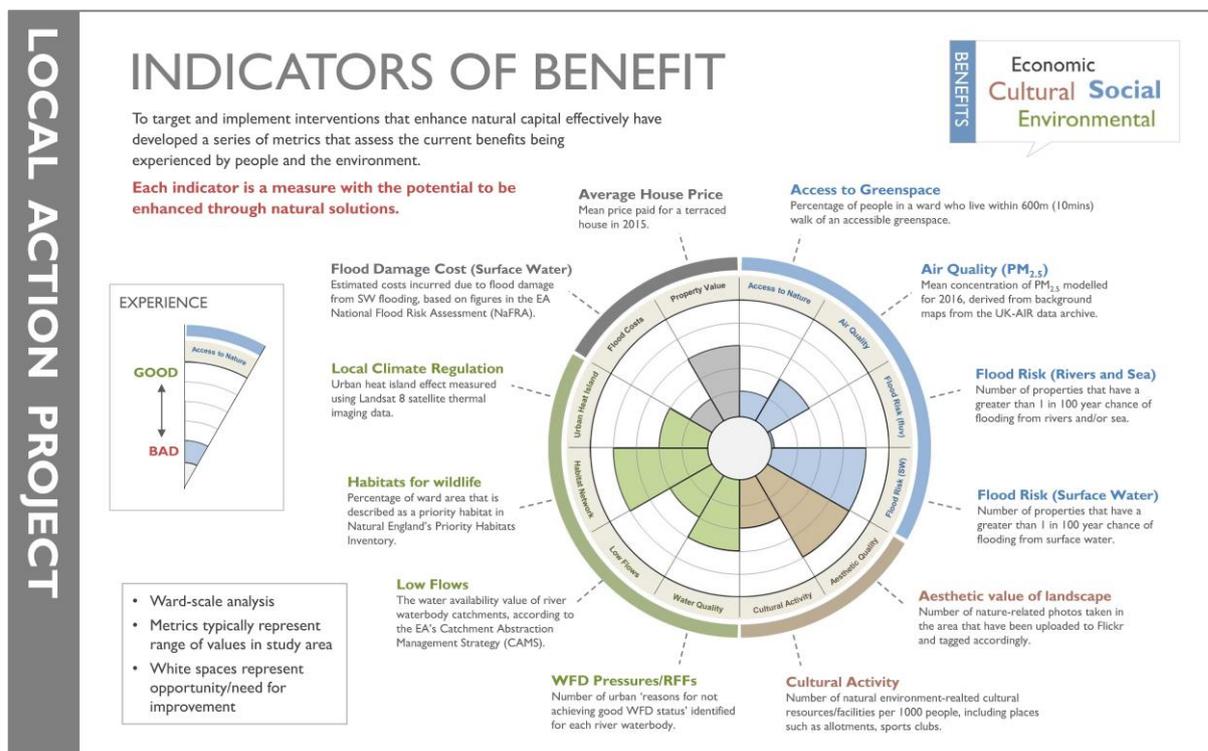
## 2.4.2. Strategic targeting using Ecosystem Service Benefits ‘wheels’

Inspired by the **‘Wheels of Water’** created by **Aqualinc Research Ltd.** in New Zealand (REF), a simple, but consistent and robust framework for the assessment of natural capital- and ecosystem services-derived benefits in urban landscapes has been developed. The multi-indicator graphics produced have been referred to as **Ecosystem Service Benefits ‘Wheels’**.

The analysis method developed uses a series of 12 ecosystem service benefit-indicators, which can be variously used to: 1) characterise the benefits derived from existing natural capital; 2) establish a baseline of benefits experienced by people living in specific communities (facilitating a strategic assessment of need for enhancement or deficiency of provision), and 3) to predict the magnitude and diversity of benefits generated through the delivery of a targeted urban environmental management intervention programme.

As the aim of the project was to develop tools that would support more effective decision making for environmental improvements in urban areas, numerous discussions were held with decision makers and local representatives in the planning of the work. Through these discussions it was identified that, while the decision makers engaged in the project recognised the importance of ecosystem services in urban areas, indicators that made explicit the current or potential benefits enjoyed by the population were required. This was to improve the utility of the work and to ensure a wide audience would be willing/able to engage with the outputs.

Figure 16. The ‘Wheel’ indicators of ESS benefits/need.



The 12 indicators selected (which are designed to be interchangeable and adjustable to suit local requirements) were absolutely required to be linked to the services provided by ecosystems and green infrastructure and the mechanisms via which each could be influenced through land-use change or environmental improvements also needed to be well understood.

The project team therefore worked closely with the decision-makers involved in the project to co-develop quantitative indicators of economic, social, cultural and environmental ecosystem service benefit provision. These had to make use of readily and freely available datasets and be able to be assessed at a community level, in order to facilitate comparisons between the benefits experienced in different areas. The sections below give methodological details of the indicators that were selected for use by the decision makers and local representatives in each of the four pilot areas.

### Social benefits provided by urban ecosystem services

Four indicators were chosen to represent social benefits provided by ecosystem services and green infrastructure in urban areas. Each indicator was assessed for the study and the value for each ward or Super Output Area calculated. These maps were presented alongside a variety of other information relating to the benefits being assessed in each case – e.g. priorities, drivers, statutory requirements, etc.

#### Access to green space

Green space in urban areas provides opportunities for recreation with strong association between exercise and physical activity with access and living distance from green space, thereby enhancing human health (Konijnendijk et al. 2013, Coombes et al., 2010; Babey et al., 2008 and Kaczynski and Henderson; 2007). In addition, positive effects of access to green space on psychological well-being and reduction in stress have also been found (Ward Thompson; Neilsen and Hansen; Grhn and Stigsdotter;).

The importance of open spaces to people living in urban environments was previously reflected in UK Government's 2002 document (now superseded) entitled, '**Planning and Policy Guidance 17: Planning for Open space, Sport and Recreation**' in which it was recognised that networks of high quality, well managed open spaces can help to create urban environments that are attractive, clean and safe and that open spaces can promote social inclusion and community cohesion; improve health and wellbeing, and lead to more sustainable development. PPG17 recommend that local authorities give existing open spaces protection and call for them to ensure that there is sufficient provision of open spaces to meet the needs of local people.

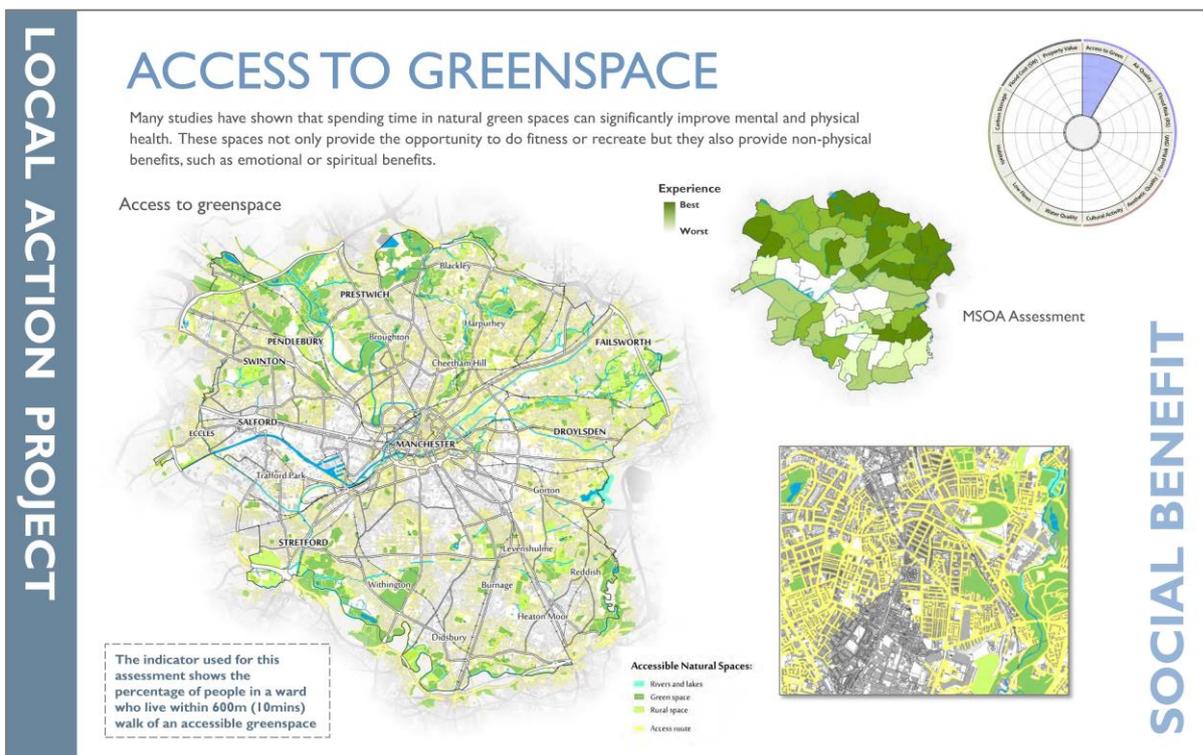
The importance of accessible open spaces to people living in urban environments is also now reflected in UK Government's 2012 **National Planning Policy Framework** in which they set out their high level policy objectives for the provision of open space. In this document they state that, '*Planning policies should be based on robust and up-to-date assessments of the needs for open space, sports and recreation facilities and opportunities for new provision. The assessments should identify specific needs and quantitative or qualitative deficits or surpluses of open space, sports and recreational facilities in the local area. Information gained from the assessments should be used to determine what open space, sports and recreational provision is required.*'

The NPPF also recommends that, '*existing open space, sports and recreational buildings and land, including playing fields, should not be built on unless: 1) an assessment has been undertaken which has clearly shown the open space, buildings or land to be surplus to requirements; or 2) the loss resulting from the proposed development would be replaced by equivalent or better provision in terms of quantity and quality in a suitable location; or 3) the development is for alternative sports and recreational provision, the needs for which clearly outweigh the loss.*'

**The indicator for access to green space was assessed by calculating the percentage of people in each SOA or ward that live within 600m (~10 mins) walk of an accessible greenspace and ranking them to indicate the highest to lowest need/opportunity for increased provision.**

This indicator is a modification of just one of the criteria assessed under Natural England's Accessible Natural Green Space Standard (ANGSt) (Natural England, 2008; Natural England, 2010). After lengthy discussion with stakeholders and end-users it was agreed that the ANGSt measures were too complex and should be simplified. This decision was taken to better align the indicator with those used by Leicester City Council in their own assessments of access to green infrastructure and open spaces assessment and with the Open Space Hierarchy Assessed in the London Plan (GLA, 2015).

Figure 17. Example map showing access to nature analysis – a cost-weighted distance analysis of walking distance



### Regulation of air quality

The regulation of air quality is also an important ecosystem service with significant social benefits in urban areas. In 2009, the Health Protection Agency’s **Committee on the Medical Effects of Air Pollutants (COMEAP)** published the first in a series of reports into the health impacts of air pollution.

The report, which examined a wide array of studies from around the world, was entitled **Long-Term Exposure to Air Pollution: Effect on Mortality** and confirmed the long-held belief that long-term exposure to air pollution does have a significant effect on mortality and causes a reduction in life expectancy.

The strongest association between air pollution and mortality was found for particulate matter (PM) air pollution and identified PM<sub>2.5</sub> as the best indicator for the quantitative assessment of particulate air pollution. A 10µg/m<sup>3</sup> increase in exposure to PM<sub>2.5</sub> was found to give an increase in the relative risk of death of 6% (95% CI 2–11%) for all-cause mortality. The effects of other pollutants such as sulphur dioxide, nitrogen dioxide and ozone are not so well understood, but may still have significant effects on mortality and life expectancy.

The COMEAP findings are in accordance with the findings of another study undertaken by DEFRA who found that poor air quality could reduce life expectancy in the UK by an average of seven to eight months and have concomitant health costs estimated to be up to £20 billion a year (DEFRA, 2007). In addition to the impacts of poor air quality on human health it is also thought to have a negative impact on the natural environment and it has been shown to reduce biodiversity.

The UK Air Quality Strategy, published by DEFRA in 2007, aims to mitigate the reduced life expectancy impact of poor air quality to five months by 2020 and calls for air quality management strategies to ensure that maximum benefits are achieved for both local air quality and climate change mitigation. Local authorities are now required to undertake Local Air Quality Management (LAQM) by the Environment Act (1995) and their air quality objectives, which provide the statutory basis for LAQM in England, were set out in the Air Quality (England) Regulations 2000.

Since December 1997 each local authority in the UK has been carrying out a review and assessment of air quality in their area. If a local authority finds any places where the objectives are not likely to be achieved, it must declare an Air Quality Management Area there. This area could be just one or two streets, or it could be

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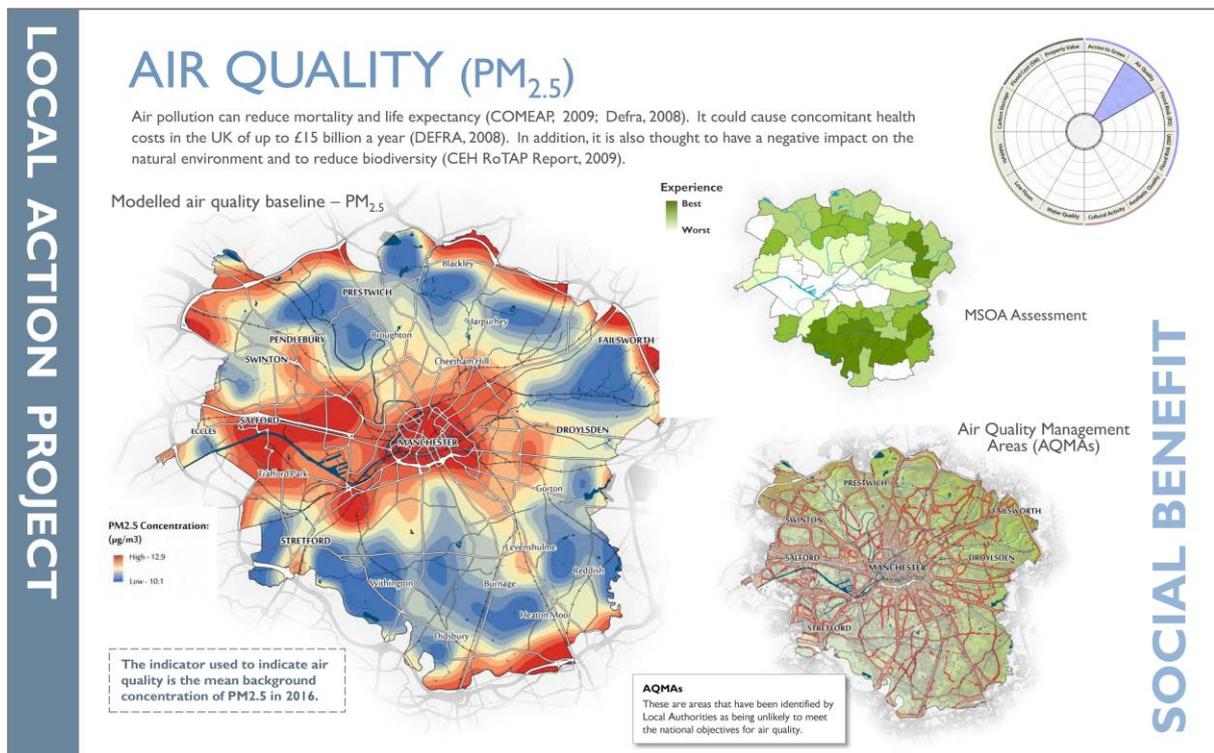
much bigger. Then the local authority will put together a plan to improve the air quality - a Local Air Quality Action Plan.

Vegetation has been shown to reduce air pollution by the filtering of pollution and particulates from the air. Up to 85% of air pollution in a park can be filtered out and up to 70% in a street with trees (Bernatzky 1983).

In order to identify areas for environmental improvements the modelled mean background concentration of PM<sub>2.5</sub> in 2016 was obtained from the Defra Air Quality Information Resource air quality (<https://uk-air.defra.gov.uk/>).

**The indicator for air quality was assessed by calculating the average concentration of PM<sub>2.5</sub> in each SOA or ward and ranking them to indicate the highest to lowest need/opportunity for improvement.**

Figure 15. Example map showing air quality assessment for benefits wheel.



### Living at risk of flooding: fluvial, coastal and surface water (pluvial)

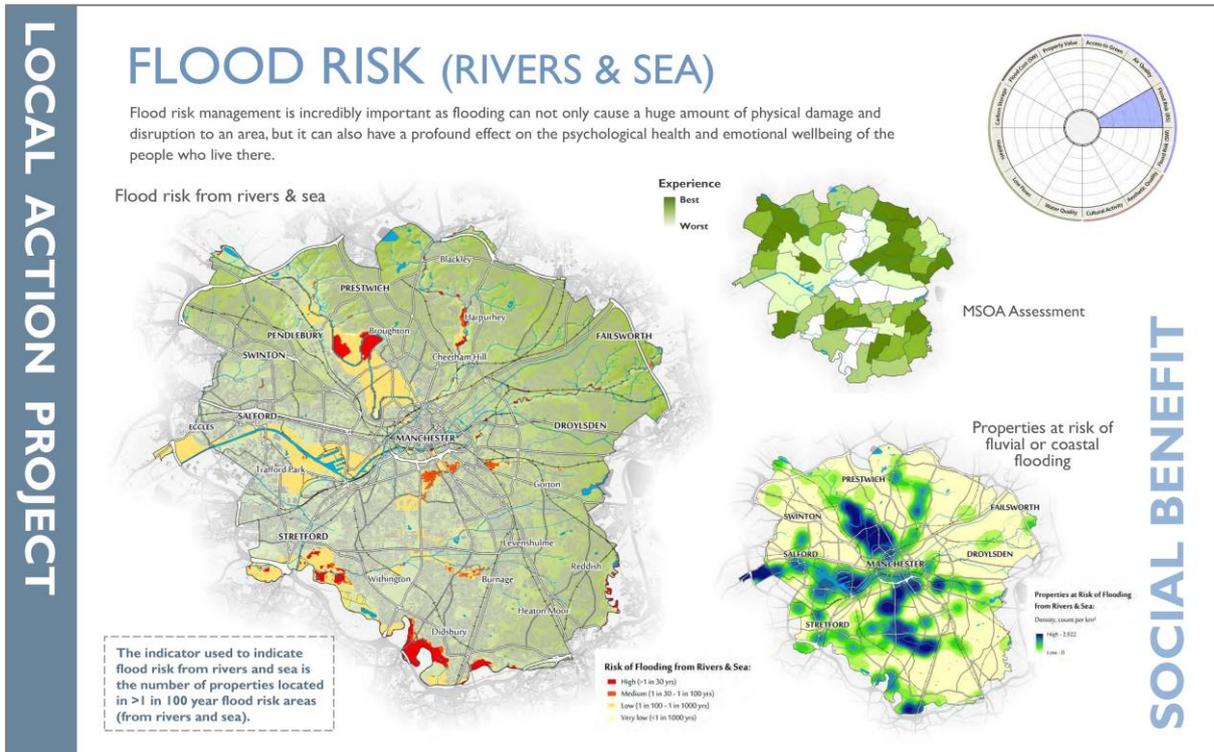
The regulation of the quantity and movement of water from either rivers and the sea or pluvial sources was also included as two separate social benefits. Living at risk of flooding or suffering the consequences of flooding can have significant impacts on the psychological health and well-being of people affected (Reacher et al., 2010; Stanke et al., 2012).

Every household at risk of flooding from either source is an additional impact on society, health and wellbeing and the healthcare system in an area.

**In light of this, the indicator for the social impacts of flood risk from rivers and sea was assessed by calculating the number of residential properties located in areas with a greater than 1 in 100 year risk of fluvial and coastal flooding (rivers and sea) in each SOA or ward and ranking them to indicate the highest to lowest need/opportunity for improvement.**

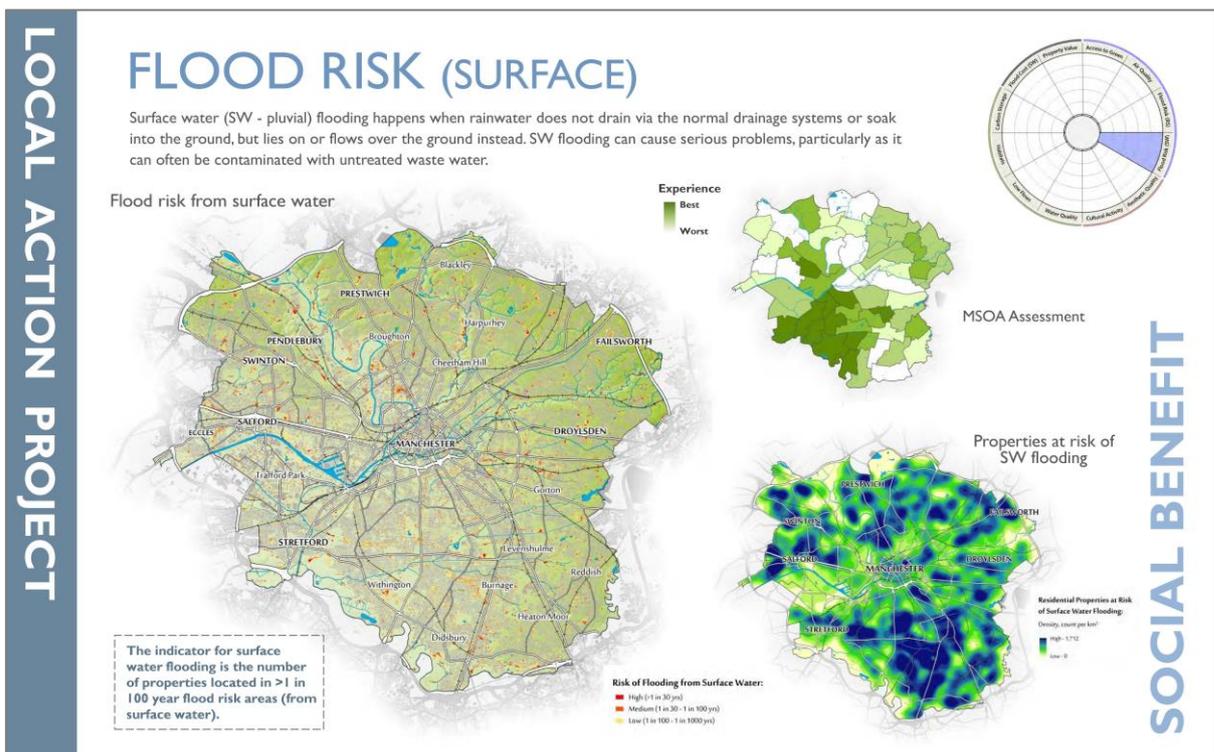
Residential properties were mapped using either AddressBase (procured from Ordnance Survey) or using MasterMap 'buildings' under 100 sq. m. in area (Ordnance Survey data obtained under licence from the Environment Agency). Flood risk areas were mapped using the Flood Risk – Rivers & Sea dataset obtained from the Environment Agency (EA Open Data – [environment.data.gov.uk/ds/partners/index.jsp](https://environment.data.gov.uk/ds/partners/index.jsp)).

Figure 16. Example map showing flood risk (rivers & sea) assessment for benefits wheel.



The indicator for the social impacts of flood risk from pluvial sources (surface water flooding) was assessed by calculating the number of residential properties located in areas with a greater than 1 in 100 year risk of surface water flooding in each SOA or ward and ranking them to indicate the highest to lowest need/opportunity for improvement. Residential properties were mapped as above, while surface water flood risk areas were mapped using the Surface Water Flood Risk dataset obtained from the Environment Agency (EA Open Data – [environment.data.gov.uk/ds/partners/index.jsp](https://environment.data.gov.uk/ds/partners/index.jsp)).

Figure 17. Example map showing flood risk (surface water) assessment for benefits wheel.



### **Cultural benefits provided by urban ecosystem services**

Two indicators were chosen to represent cultural benefits provided by ecosystem services and green infrastructure in urban areas. Each indicator was assessed for the study and the value for each ward or Super Output Area calculated. These maps were presented alongside a variety of other information relating to the benefits being assessed in each case – e.g. priorities, drivers, statutory requirements, etc.

Cultural services are the non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experience (Millennium Ecosystem Assessment 2005). In urban areas these ecosystem services may be among the highest valued (Kaplan and Kaplan 1989; Bolund and Hunhamar 1999 ; Chiesura 2004 ; Konijnendijk et al. 2013).

Several recent studies have attempted to identify indicators that be developed from readily available information to compare the quality or cultural benefits provided by environmental assets at a local level (Tratalos et al., 2016; Antognelli and Vizzari, 2016; La Rosa et al., 2016).

It is important to note that, rather than attempting to assess the actual magnitude of these intangible benefits, it is simpler to characterise the provision of the natural assets or 'environmental spaces' in a landscape which are the functional units of cultural ecosystem service provision (Tratalos et al., 2016).

Very few geo-spatial assessment methods have been found to map and quantify the provision of cultural ecosystem service benefits by natural assets in urban landscapes, but two methods that have been developed are; the use of social media data to characterise the aesthetic value or quality of a landscape (Richards and Friess, 2015; Alfaro and Wagner, 2015; Keeler et al., 2015) and the spatial assessment of 'environmental spaces' or resources for cultural activity (Tratalos et al., 2016).

#### ***Aesthetic value (or landscape quality)***

Social media data, particularly geo-tagged photographs, have been demonstrated to be a quick and inexpensive method to obtain spatially explicit and contain visual information that can be used to infer cultural use (Richards and Friess, 2015).

In light of this, to assess the aesthetic value of the SOAs or wards in the Demonstration Areas the concentration of geo-tagged photos related to nature on the social media site Flickr was determined.

***The indicator for the aesthetic value of the landscape was assessed by calculating the number of Flickr-posted photos tagged per SOA or ward which had been tagged with keywords relating to ecosystems and nature was recorded and ranking them to indicate the highest to lowest need/opportunity for improvement.***

Tags used were woodland, woods, river, soar, wetland, water, park, grass, flowers, tree, leaf, nature, wildlife, beautiful, landscape, summer, autumn, winter, bird.

#### ***Cultural resources & activities***

Green infrastructure and open spaces present the opportunity for a variety of cultural activities, these represents opportunities for increased learning opportunities, retention of ecological and local knowledge, a sense of place (Kudryavtsev et al., 2012), increased environmental awareness and commitment (Karvonen 2010), as well as social cohesion, neighbourhood participation and tolerance (Dines & Cattell, 2006).

***The indicator for natural resources for cultural activities and resources was assessed by determining the number of cultural activity groups or facilities related to nature per 1000 people in each SOA and ranking them to indicate the highest to lowest need/opportunity for improvement.***

Data on cultural activity groups or facilities was obtained from a variety of our sources, including <http://onlinelibrary.wiley.com/doi/10.1890/140124/full>

Figure 15. Example map showing air quality assessment for benefits wheel.

Figure 18. Example map showing aesthetic value assessment for benefits wheel.

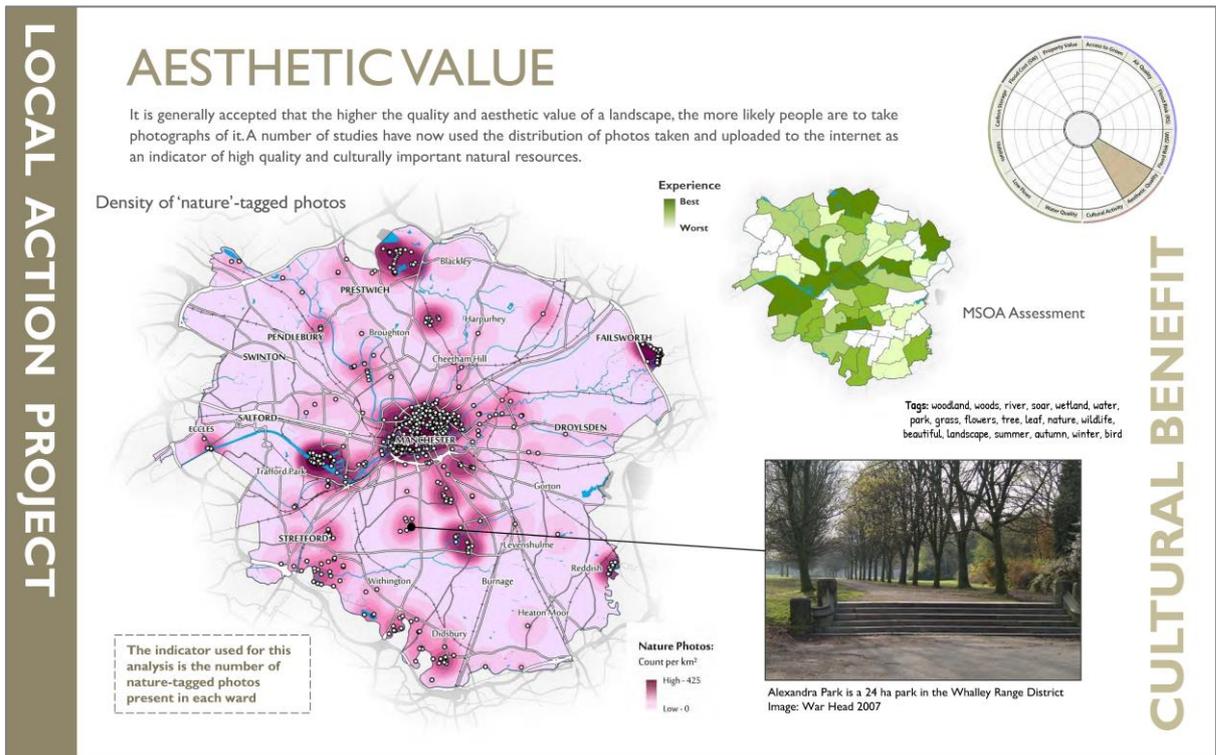


Figure 19. Example map showing cultural resources value assessment for benefits wheel.



### Environmental benefits provided by urban ecosystem services

Four indicators were chosen to represent the environmental benefits provided by ecosystem services and green infrastructure in urban areas. Each indicator was assessed for the study and the value for each ward or

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Super Output Area calculated. These maps were presented alongside a variety of other information relating to the benefits being assessed in each case – e.g. priorities, drivers, statutory requirements, etc.

### **Water quality**

The Water Framework Directive (WFD) 2000 (EC/2000/60) introduced more rigorous and higher evaluation standards for the quality of our aquatic ecosystems. WFD is based on the principle of Integrated River Basin Management Plans, which are designed to ensure that aquatic ecosystems are managed in a coherent and sustainable manner. The main objectives of the WFD are to prevent the deterioration of aquatic ecosystems and to protect, enhance and restore polluted waters to 'good status', a measure that is based on both ecological and chemical factors.

When a WFD classification element is at less than 'good ecological status' or there is a risk that its condition may deteriorate, then it is often necessary for actions to be taken that improve the status to good or to mitigate the risk of deterioration. In order to identify appropriate actions required, it is first necessary to understand the pressure acting on the condition of that waterbody, the factors acting to generate that pressure and where the pressure is derived from.

The water quality in urban waterbodies can be impacted by pressures derived from a variety of sources. Many point- and diffuse-sources of pollution are derived from the rural landscape upstream, while others are derived from within the urban landscape itself. As a result of this complexity, the WFD elemental classifications, which examine the ecological and chemical 'status' of each waterbody, do not necessarily give a clear indication of the pressures acting on the urban water environment or their sources in the catchment.

As the urban practitioner's 'toolbox' developed during this project is intended to be delivered within the urban landscape to improve water quality, it is therefore important that our water quality indicator identifies where pressures acting to degrade water quality are correspondingly derived from within the urban landscape.

The causes of waterbody failures (Reasons for Not Achieving Good Status – RNAGs), when they are known, are recorded by the Environment Agency in the WFD Reasons for Failure (RFF) or RNAGs Database using a defined set of reasons for failure, along with the pressure(s) driving that failure. In addition, where applicable, an indication is also given of the relative contribution that each reason and pressure are making to that failure (source apportionment).

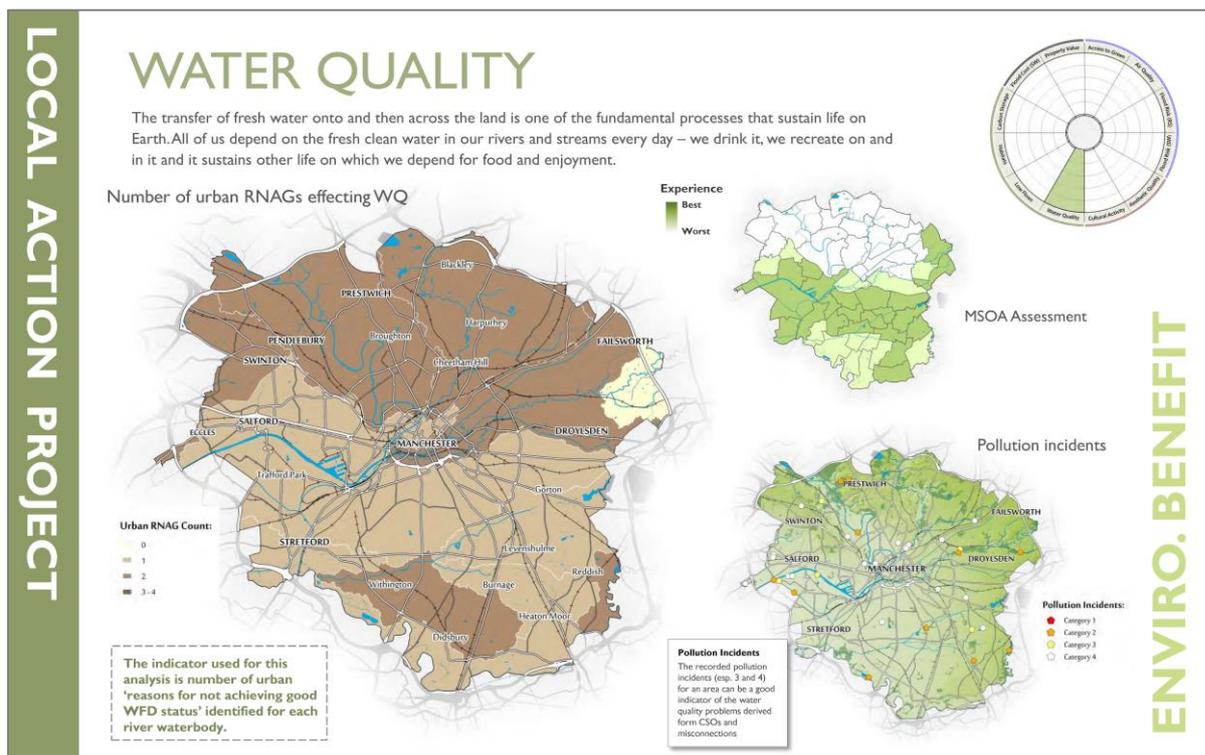
If more than one reason for failure is identified for a failing element (or for a pressure affecting a biological element) then the source apportionment of each reason for failure is needed – otherwise they are regarded as having equally weighted impacts on the ecological condition of the waterbody.

Given that one of the key distinctions in the RNAGs database is whether the pressure acting to degrade water quality is derived from a rural or urban source, we took the number of urban-derived pressures/RNAGs as a good indicator of the complexity and magnitude of the urban-derived water quality challenge faced in each waterbody.

The number of urban RNAGs in each SOA or ward was determined using information from the Environment Agency's River Basin Management Plan data. Where a SOA or ward was intersected by multiple waterbodies the value was averaged across it by area.

***The indicator for water quality was assessed by determining the number of urban Reasons for Not Achieving Good Status in each SOA or ward and ranking them to indicate the highest to lowest need/opportunity for improvement.***

Figure 20. Example map showing water quality assessment for benefits wheel.



### Water Quantity – low flows

In addition to improvements to water quality, ecosystem functioning also heavily affects water quantity (Coates et al). There are a number of locations in a catchment landscape (and this is especially vital in urban landscapes) where a reduced ability for an ecosystem to maintain base flows in rivers during periods of low rainfall will have a negative impact on the ecosystem services benefits experienced by people living in that landscape.

Water quantity in a river has a direct bearing on the effluent volumes and concentrations that can be discharged from point sources of pollution. Sufficient flows are also required to ensure that effluent is diluted appropriately downstream and (where abstraction intake licences exist for drinking water supply) there is a clear need for base-flows to be maintained. Rivers also require sufficient flow during dry periods to remain in good ecological condition.

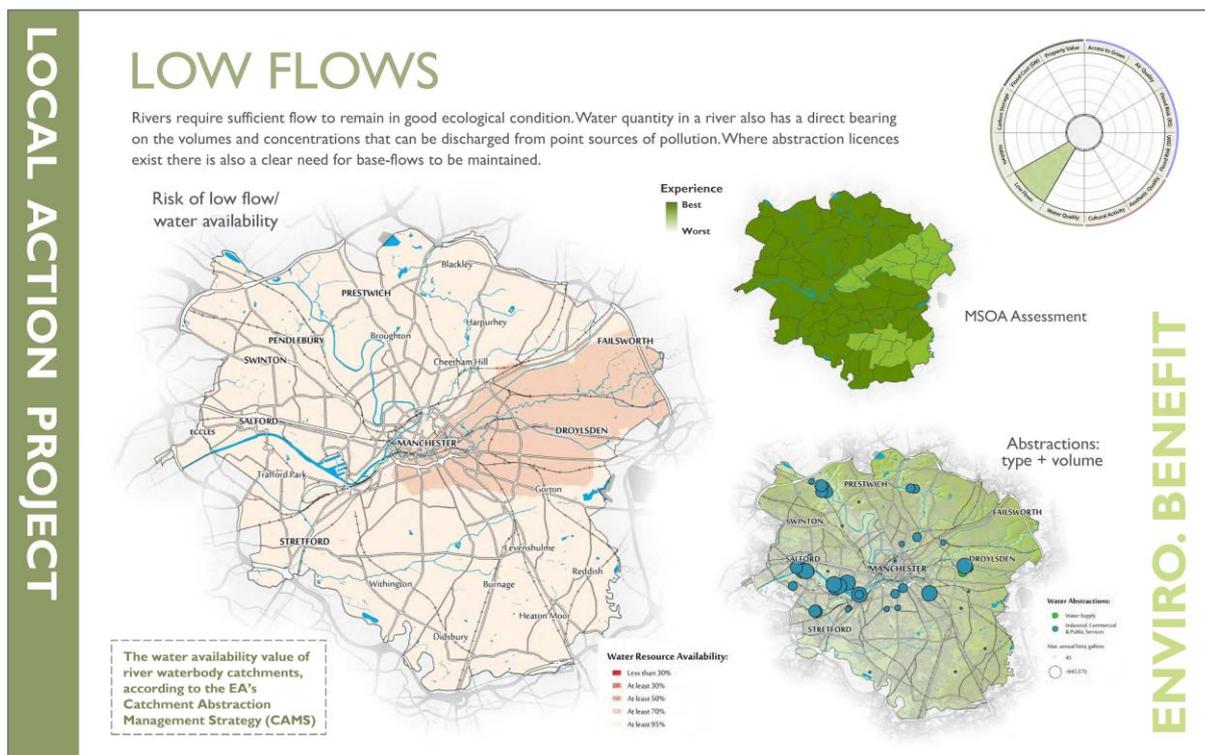
In order to assess the scale of any problems or deficiencies in ecosystem service provision from a catchment, we need to collate and assess all of the data and evidence linked to the assessment of water quantity for the maintenance of base flows. When considering the provision of an ecosystem service, such as the regulation of water flow, it is important to consider the time at which the greatest demands are placed on the service and to look into the future to assess whether greater demands will be placed on the service in the future.

The Environment Agency is responsible for managing water resources in England and they use the catchment abstraction management strategy (CAMS) process and abstraction licensing strategies to do this. They also identify where reduced flow may be causing rivers to be ecologically degraded through the WFD Classification and the Reasons for Failure Database.

**The indicator for water resources – low flows was assessed by determining the water reliability predicted for each waterbody in the EA’s Catchment Abstraction Management Strategy (CAMS) assessment and averaging this out across each SOA or ward and ranking them to indicate the highest to lowest need/opportunity for improvement. Note that this indicator was not a relative score within the urban area, but a reporting of the environmental performance against the national benchmark.**

EA CAMs data was obtained from the Environment Agency data share website and is part of the CaBA GIS Data package (EA Open Data – [environment.data.gov.uk/ds/partners/index.jsp](http://environment.data.gov.uk/ds/partners/index.jsp)).

Figure 21. Example map showing low flows assessment for benefits wheel.



### Habitat provision (ecological network)

The species and biodiversity that occur in a catchment landscape are supported by the network of natural habitats and greenspaces that currently exist in the catchment landscape. Ecological theory suggests that the habitat patches must be of a particular extent and have sufficient connectivity between them in order for the landscape to have a functional ecological network and for the assemblage of species to be supported at the correct level.

The ecological network in an urban landscape and the biodiversity it supports is a key supporting ecosystem service which is required for the production of all other ecosystem services, especially social and cultural services in urban landscapes (Teeb, UK NEA).

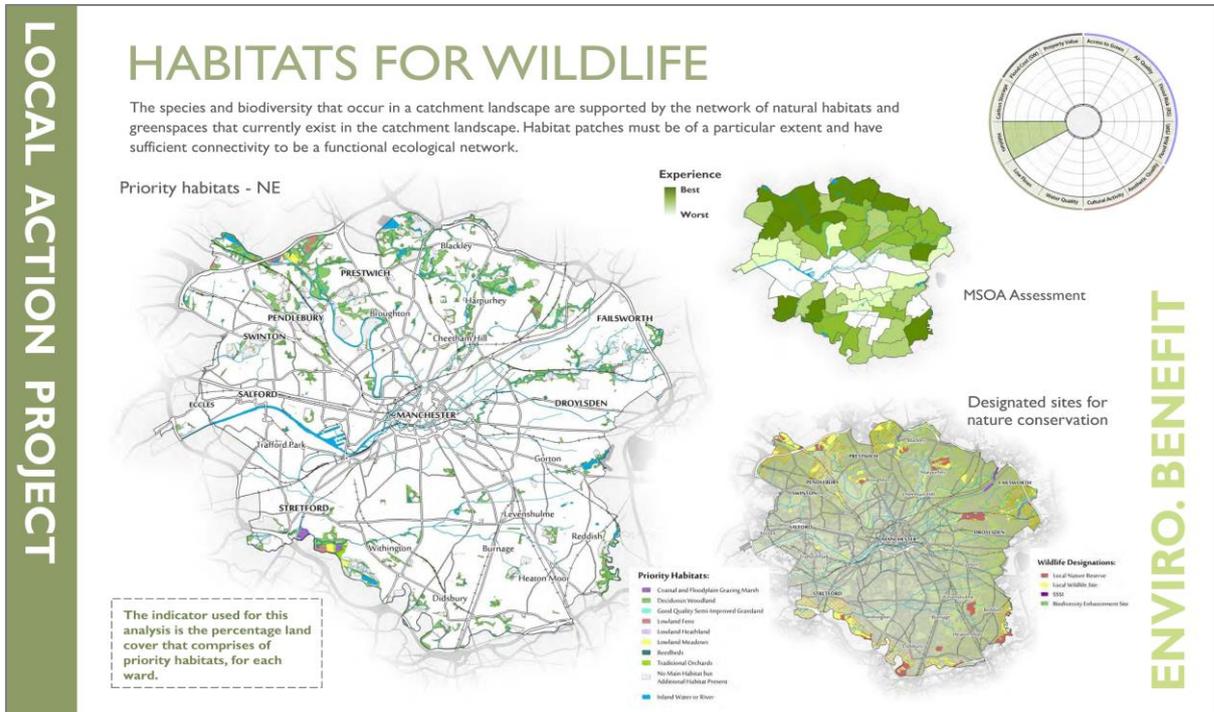
The conservation of wildlife and biodiversity in the UK has traditionally focused on three principal approaches: (1) the protection of important species and habitats through designation and protection of high quality habitats supporting priority species, (2) the creation and management of wildlife habitats on farmland through agri-environmental schemes (the so-called 'pillar 2' of the EU's Common Agricultural Policy), and (3) the protection or creation of natural spaces in urban areas (greenspaces) through local planning processes.

Before any work is done it is vital that the habitat components of the landscape are mapped and that work is undertaken to protect and enhance them – there is no point working to add to the ecological network in a landscape if the current infrastructure in the landscape is being degraded or damaged at the same time.

There are numerous data and evidence available for the assessment of ecological health/biological richness/wildlife across a catchment landscape. Designated sites are classified according to their condition and rivers and other aquatic ecosystems are assessed via a number of metrics, including the WFD ecological assessments made each year. In addition to these assessments there are also data on the long-term abundance of several key indicator species (mammals, farmland and woodland birds, breeding birds, plants etc), which can be used to indicate whether the biodiversity/wildlife in a landscape is declining or increasing. Finally, there are number of analytical methods which can be used to determine whether habitats present represent a functional ecological network (e.g. Fragstats).

The indicator for habitat provision was assessed by determining the area of priority natural habitats in each SOA or ward and ranking them to indicate the highest to lowest need/opportunity for improvement.

Figure 22. Example map showing habitats for wildlife assessment for benefits wheel.

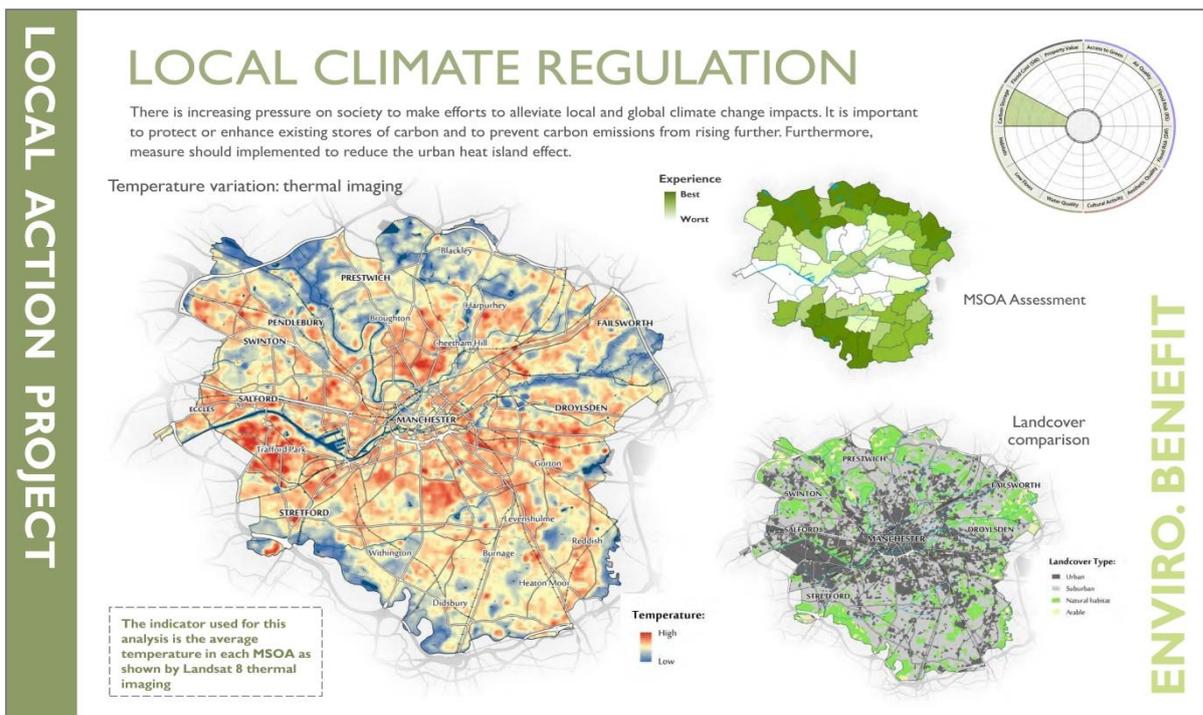


**Local climate regulation**

Health and wellbeing can be severely impacted by the urban heat island effect, which is a result of the large areas of heat absorbing surfaces in combination with higher amounts of energy use in city areas (Bolund & Hunhammar, 1999). Vegetation and urban trees reduce urban temperatures through shading and the consumption of heat energy through evapotranspiration. Additionally, in winter trees reduce heating costs by disrupting wind speeds (McPherson et al., 1997). The regulation of local climate was measured using Landsat 8 thermal imaging data collected in the summer months.

The indicator for local climate regulation was assessed by determining the average temperature in each SOA or ward and ranking them to indicate the highest to lowest need/opportunity for improvement.

Figure 22. Example map showing local climate regulation assessment for benefits wheel.



### Economic benefits provided by urban ecosystem services

Two indicators were chosen to represent economic benefits provided by ecosystem services and green infrastructure in urban areas. Each indicator was assessed for the study and the value for each ward or Super Output Area calculated. These maps were presented alongside a variety of other information relating to the benefits being assessed in each case – e.g. priorities, drivers, statutory requirements, etc.

### Cost of flood damage

In addition to the social impacts resulting from people living at risk of flooding and being flooded, there are also economic impacts of flooding – the actual cost of the damage done and the impacts on the local economy of infrastructure damage and disruption to services.

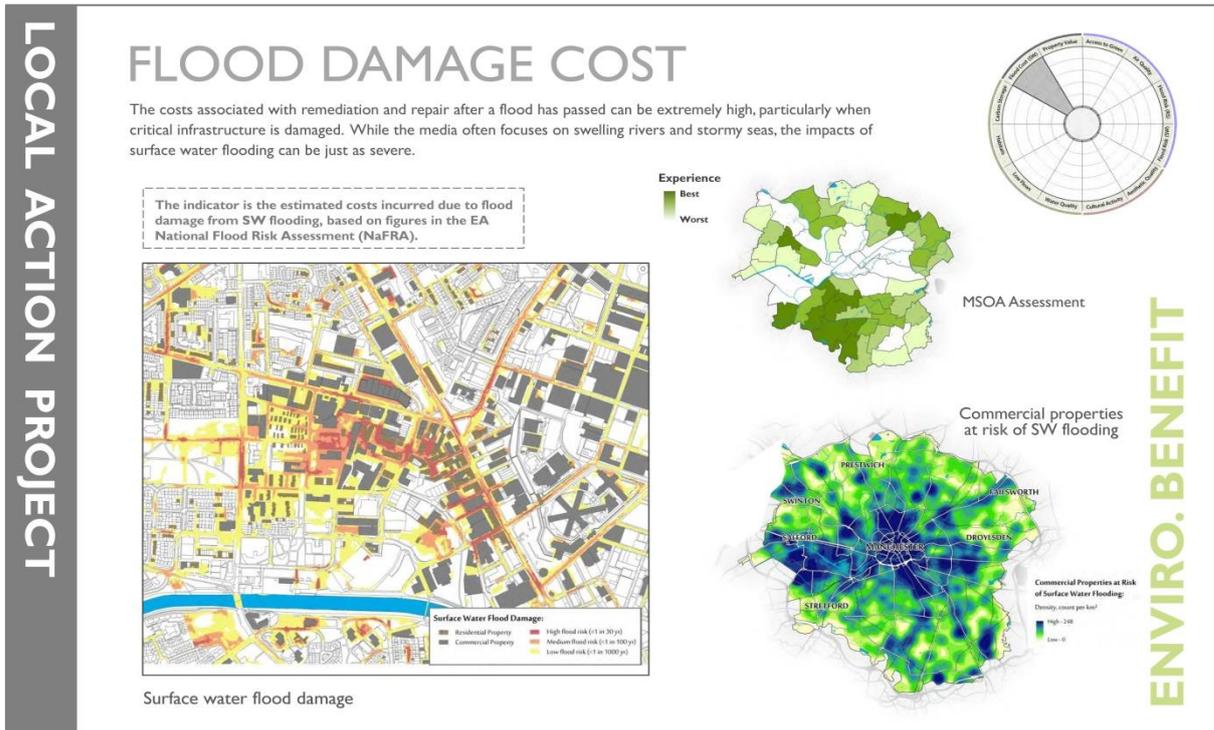
The Environment Agency uses a method based on the National Flood Risk Assessment (NaFRA) for England and Wales to estimate economic damages resulting from flooding each year in any specific location. NaFRA, using a method called Risk Assessment for Strategic Planning (RASP), produces a broad-brush assessment of the likelihood of flooding at a national scale, based on assessments undertaken for 85 river catchments and coastal cells (areas) divided up into 50 x 50m squares. It enables a comparison of the relative risks and their distribution within each of these catchments, rather than a detailed, local assessment of the risk at a specific location.

The calculations provide an indication of the likelihood of flooding at the centre of each of the 50 x 50m squares. These results are then placed into three likelihood categories as used by the insurance industry. The three likelihood categories are: 1) low - 0.5% (1 in 200) chance of flooding each year or less; 2) moderate - 1.3% (1 in 75) chance or less but greater than 0.5% (1 in 200) chance in any year, or 3) significant - greater than 1.3% (1 in 75) chance in any year.

To calculate the cost of flood damages for this indicator a simplified application of the NaFRA Damage Calculation Methodology (EA, 2013) was applied. This was necessary as much of the data used in the full analysis is commercial data, however, the method was deemed appropriate by the EA for this use.

**The indicator for the cost of flood damages was assessed by calculating the total estimated cost of flood damages in a year in each SOA or ward and ranking them to indicate the highest to lowest need/opportunity for improvement.** The indicator was generated using the Environment Agency’s (EA) National Flood Risk assessment (NaFRA) available from the EA’s geostore (<https://data.gov.uk>).

Figure 23. Example map showing flood damages costs assessment for benefits wheel.



### Property values

It has been shown that a high-quality public environment that is pleasant and well-maintained increases footfall in retail areas and offers very clear benefits to the local economy in terms of stimulating increased house prices, since house-buyers are willing to pay to be near green space (REFs). In fact, there are a number of factors, both environmental and socioeconomic, that have a positive and/or negative impact on the quality of life (or 'liveability') of the urban landscape and several studies have now used the value of property as an indicator of this landscape quality or value.

For example, a hedonic pricing methods have been used to show that noise and the negative visual impact of road construction were correlated with reductions in house prices (Lake et al., 1998), that open spaces such as public parks, natural areas and golf courses can have a significant positive influence on the sale price of homes in close proximity to those resources (Bolitzer and Netusil, 2000) and that 'greening' of urban landscapes can have a significant effect on elevating housing markets in those areas (Conway et al., 2010; Luttik, 2000; Jim and Chen, 2006).

From this, it is clear that any intervention to 'green' or enhance the aesthetic quality of the urban landscape or that enhances the quality of life of people living there has the potential to elevate property values in that area and that this may be something desirable for the people living there (although it may be undesirable as well). Perhaps more importantly this economic indicator is particularly useful as measure of regeneration in urban areas. It is very important that this indicator is caveated with a clear explanation of what it does and does not show – clearly the factors underpinning property values are hugely complex, but in this approach they are simply used to identify areas where property values are, on average, low and where urban environmental interventions could play a role in elevating them.

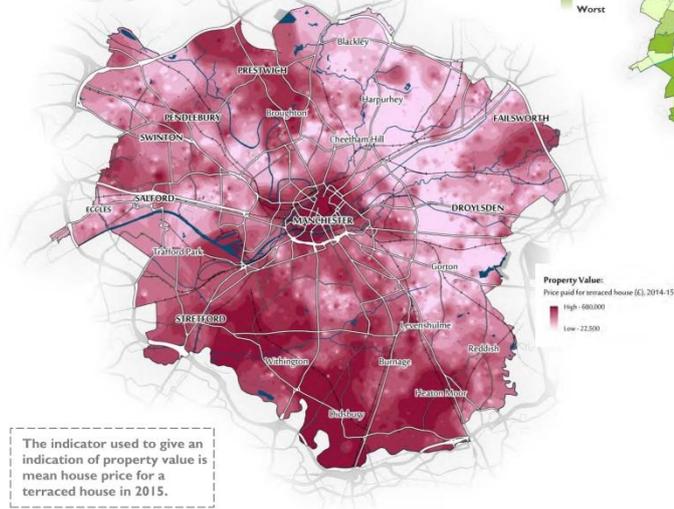
**The indicator for property value was assessed by calculating the average price paid for a terraced house between 2014 and 2015 in each SOA or ward and ranking them to indicate the highest to lowest need/opportunity for improvement.**

Figure 24. Example map showing average property value assessment for benefits wheel.

# PROPERTY VALUE

A high-quality public environment that is pleasant and well-maintained increases footfall in retail areas and offers very clear benefits to the local economy in terms of stimulating increased house prices, since house-buyers are willing to pay to be near green space.

Average sale price of a terraced house

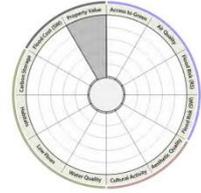


The indicator used to give an indication of property value is mean house price for a terraced house in 2015.

Experience  
Best  
Worst



MSOA Assessment



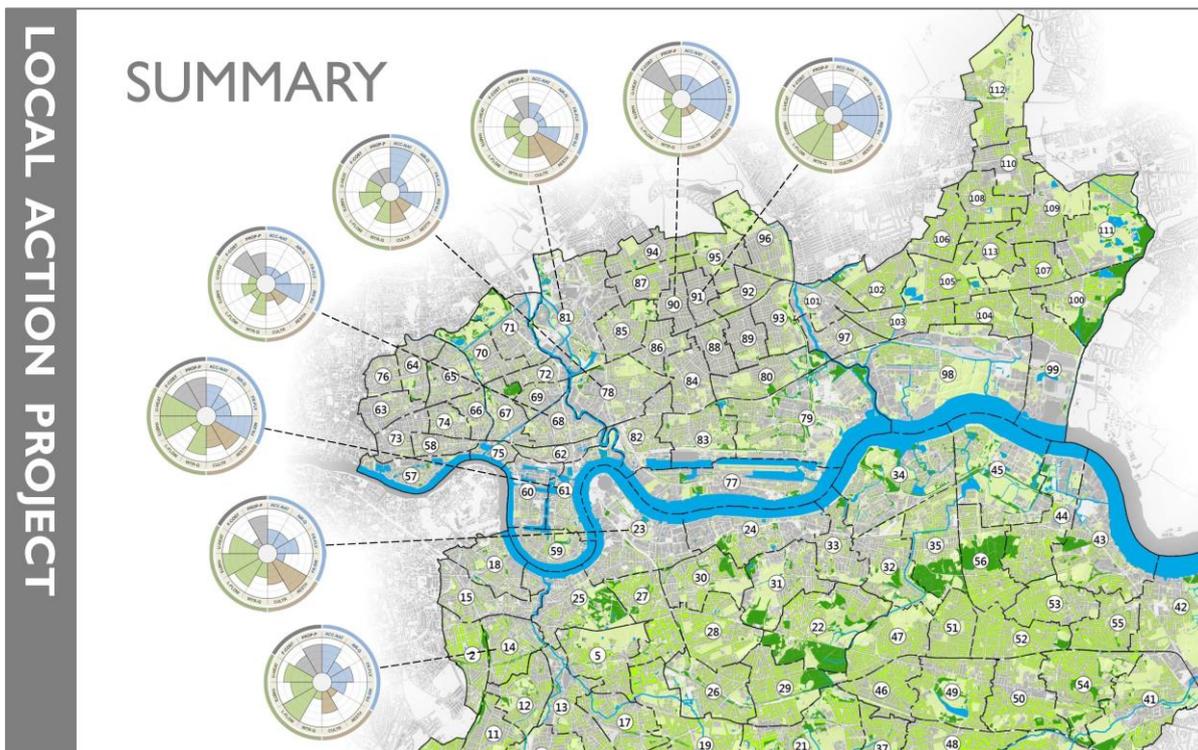
ENVIRO. BENEFIT

## Presentation of the benefit indicators

For each Demonstration Areas under study, the SOA or wards were ranked for each of the 12 indicators. This then enabled the Benefit Wheels to be created and mapped to give a strategic overview of the ecosystem services needs of the people living in each community.

By giving people an engaging and highly visual multi-parameter assessment of need/opportunity for action, the Wheels stimulate an informed discussion among local stakeholders, practitioners and decision-makers. This in turn should help them build consensus/ambition, develop a shared vision and expedite a more robust and informed decision-making process at a local scale.

Figure 25. The 'Wheel' indicators of ESS benefits/need.



### 2.4.3. Opportunity mapping and scenario development for delivery of urban 'toolbox'

Having undertaken the strategic 'needs' or opportunity assessment, a series of high priority target areas were identified in which more specific targeting of opportunities for intervention and scenarios of measures could be developed.

In each target area under study the feasibility criteria for the different interventions were used to perform detailed opportunity mapping and the capacity for the target area landscape to receive a blended suite of interventions determined. This opportunity mapping can be tailored and modified to meet the needs of the practitioners and stakeholders in the specific urban area under study.

The methods used for the detailed targeting of interventions, the development of the scenarios and the cost-benefit assessment of these scenarios are set out in the LAP Methodology which has been published as a supplementary annex to this report. The outputs of these analyses are presented in the LAP Evidence Reviews for each of the Demonstration Areas, which have also been published as supplementary annexes to this report.

Once the opportunity mapping had been completed and the capacity of the landscape to receive a suite of interventions determined, then the cost and benefits of this delivery scenario were also calculated to gain an understanding of what contribution could be made to enhancing the magnitude and diversity of ecosystem service benefits provision over and above the baseline characterised in the strategic 'needs' assessment.

## 2.4.4. Compendium of 'best practice' case studies

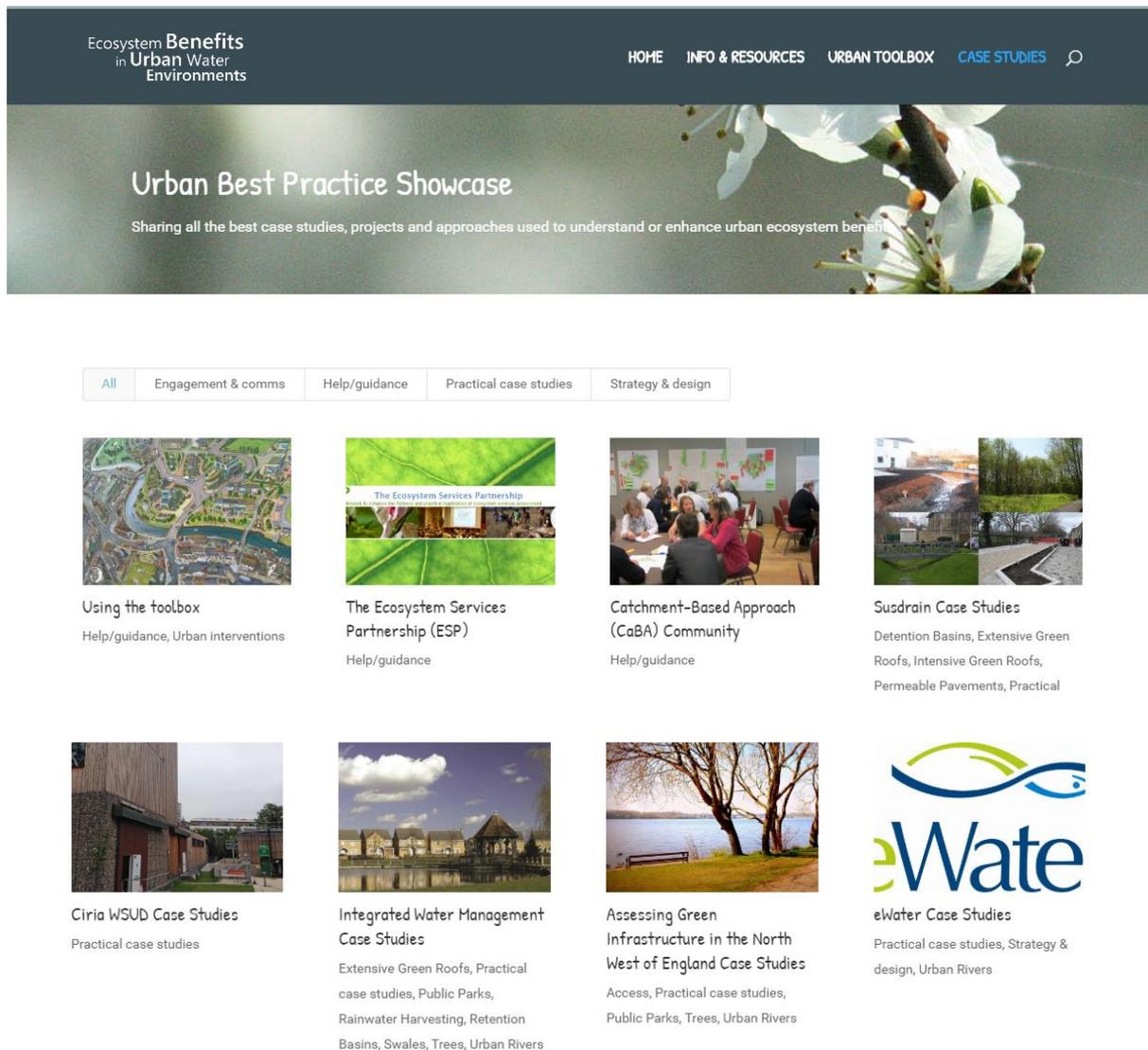
Case studies are a powerful method for those attempting to influence and persuade a diverse array of stakeholders, policy-makers and practitioners with hugely variable levels of prior knowledge and experience (Eisenhardt and Graebner, 2007). Case studies are a good way to inspire and motivate people, build ambition, stimulate innovation, illustrate what might be possible and initiate collaboration (Siggelkow, 2007).

However, in order to be effective in supporting influencing, case studies must be provided in a format, language and to a level of detail that is both correctly pitched for the audience and applicable by influencer or broker. Furthermore, in order for an influencer or broker to ensure that they can select case studies that are relevant and informative for any particular audience, it is vital that there is a broad selection covering all of the potential circumstances that may arise.

To meet this need, the LAP has collated over 100 case studies relating to environmental infrastructure and ecosystem services evaluation and enhancement in urban landscapes. These case studies are divided into a number of categories relating to different stages of integrated catchment management cycle and different types of activity - i.e. strategic planning, cost-benefit assessment, collaborative approaches, engagement and practical delivery of interventions.

All of the case studies curated for the LAP are presented on the project website - <http://urbanwater-eco.services/> and a compendium of case studies document forms an annex to this report.

Figure 25. Screenshot of website showing compendium of case studies.



### 2.5. Piloting the ESS Visualisation Framework

The approach for visualising and budgeting ecosystem services provision in urban landscapes (based on the ESS Visualisation Framework developed by Westcountry Rivers Trust and the cost-benefits assessment framework developed with the EA Economics Team), was developed via a participatory iterative process in four carefully selected urban catchment landscapes: Demonstration Areas.

These areas were chosen due to the level of engagement of a variety of stakeholders in each area (a list of decision makers involved with each study area can be found in supplementary information). This was necessary as input from end-users was considered extremely important in order to test the development of the method.

The outputs were developed in collaboration with the local catchment partnership and wider stakeholders in these Demonstration Areas and were comprised of a comprehensive evidence-base presented in an easy to understand way so that the partnership can make strategic decisions on targeting their interventions into the most cost-beneficial areas.



#### LEICESTER

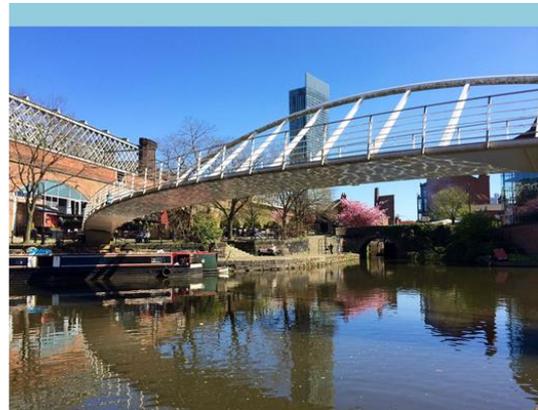
Leicester is a city and unitary authority area in the East Midlands of England, and the county town of Leicestershire. The city lies on the River Soar and at the edge of the National Forest.

In the 2011 census the population of the Leicester unitary authority was c.330,000 making it the most populous unitary authority in the East Midlands region. The associated urban area is also the 11th largest by population in England and the 13th largest in the United Kingdom.

Leicester is covered by the River Soar Catchment Partnership, which is hosted by Trent Rivers Trust and comprised of over 20 organisations, including: Leicester City Council, the Environment Agency, Natural England, Severn Trent Water and Loughborough University. The RSCP is also a Demonstration Catchment under the EU WaterLIFE Project.

[www.waterlife.org.uk/the-project/where-we-work/soar/](http://www.waterlife.org.uk/the-project/where-we-work/soar/)

[www.trentriverstrust.org/site/river-soar](http://www.trentriverstrust.org/site/river-soar)



#### MANCHESTER

Manchester is a major city in the northwest of England with a rich industrial heritage. The city is fringed by the Cheshire Plain to the south, the Pennines to the north and east and is surrounded by an arc of towns with which it forms an almost continuous conurbation - Greater Manchester.

The city has a population of 514,417 (as of 2013), while the conurbation of Greater Manchester is the UK's second-most populous urban area, with a population of 2.55 million.

The city of Manchester is covered by two catchment partnerships: the Irwell in the north east (hosted by Groundwork Manchester) and the Upper Mersey in the south an west (hosted by the Healthy Rivers Trust).

Most recently, Manchester has become the focus of two significant projects: the LIFE Integrated Project (led by the Environment Agency), which will be focusing on partnership-working on the Irwell Catchment, and the Defra Urban Pathfinder initiative, which will be looking at Manchester.

[www.groundwork.org.uk/sites/msstt](http://www.groundwork.org.uk/sites/msstt)

[www.healthywaterwaystrust.org.uk](http://www.healthywaterwaystrust.org.uk)



### NEWTON ABBOT

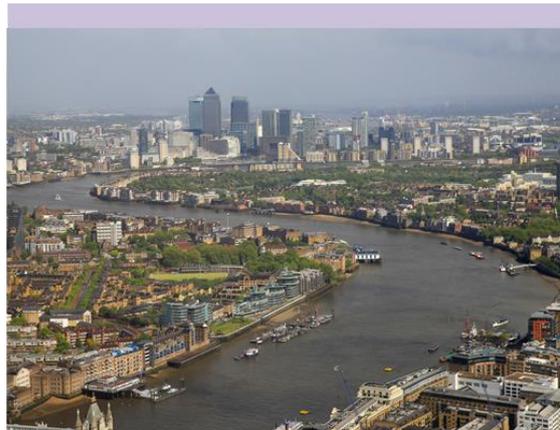
Newton Abbot is a small market town and civil parish in the Teignbridge District of Devon, England on the Rivers Lemon and Teign at the head of the Teign Estuary. The town lies to the east of Dartmoor National Park. The town has a population of 25,556.

The South Devon Catchment Partnership is being hosted jointly by the South Devon AONB and the Westcountry Rivers Trust, supported by the Environment Agency. The SDCP have undertaken a number of planning workshops, produced an ecosystem services evidence review and developed a catchment action plan.

They have also worked to engage local authorities across the catchment with Teignbridge Council particularly keen to look at natural capital in urban landscape management as their Local Plan is being delivered and will soon be reviewed.

[www.swcatchments.info/?page\\_id=41](http://www.swcatchments.info/?page_id=41)

[www.teignbridge.gov.uk/localplan](http://www.teignbridge.gov.uk/localplan)



### THAMES ESTUARY

The tidal Thames extends from Teddington in the west to Sheerness (Kent) and Shoeburyness (Essex) in the east.

The urban area that surrounds the estuary has been defined in numerous ways depending on the subject or sector of interest, but there are 34 London Boroughs with Estuary frontage with a combined population of 7.2 million people.

Thames Estuary Partnership is committed to maintaining and improving the landscape of the Thames, whether that is through infrastructure and engineering projects, trade development, water quality and resource management or natural habitat conservation.

Hosted by University College London (UCL), TEP has been building networks, delivering projects and facilitating partnership programmes across its target area for the past 20 years.

[www.thamesestuarypartnership.org](http://www.thamesestuarypartnership.org)



Overall, the feedback from the stakeholders engaged in the development of the LAP approach in the Demonstration Areas has been very positive. The Deputy Mayor of Leicester, Cllr Adam Clarke, is keen to disseminate the project throughout Leicester City Council and members of the catchment partnerships (both CaBA hosts and government agencies) have commented on the usefulness and suitability of the approach.

*“...hopefully it should prove to be a very useful evidence base for us to use to develop ideas and bid for Leicester and the local area (as well as the other areas)...we would like to use it to identify concrete lined watercourses that flow near public open space and land earmarked for development, metrics for all open spaces (particularly those where there is a watercourse going through) and to include stats for communities within walking distance of each site. This will be useful for a Green Blue Infrastructure bid across Leicester...”*

Ruth Needham, Trent Rivers Trust, Leicester

*“...The Local Action Project approach has been very well received in and around Manchester. Its outputs including the evidence review will be really helpful and will enable partnerships to prioritise. Having information for each ward is particularly useful...”*

Caroline Riley, Healthy Rivers Trust, Manchester

*“...The [LAP] work...is greatly appreciated and builds on work that had already commenced in the City to support the best and more robust use of green space within an urban environment. The robust review to help quantify and promote best practice that the steering group have been informed about is particularly useful and will help inform on most appropriate use of particular sites...”*

Helen O'Brian, Leicester City Council

As part of the dissemination and preliminary evaluation of the LAP, Alex Collins met with Lindsay McCulloch (Planning Ecologist at Southampton Council) to review the approach on 14<sup>th</sup> March 2016 (meeting notes are included in Appendix 4).

Overall, Lindsay was very impressed with the LAP approach, stating that it was, in her opinion, the most easily understood method to describe ecosystem services and benefits provided by natural capital she had seen. She found it refreshing that the LAP approach had recognised the importance of communication rather than just simple mapping or spreadsheets, which she felt would not get the support that is required.

She also thought that the presentation of the benefits provided by GI in a wheel was easy to understand by non-technical audiences and allowed easy comparison which would facilitate engagement with local communities and councillors. She agreed that Super Output Areas or even Lower Super Output Areas would be the best level to describe benefits provided by green infrastructure (GI) as this avoids the politics associated with wards and matches the scale used to map social deprivation.

### 2.6. Knowledge transfer within the urban catchment management ‘community of practice’

The primary aim of the knowledge transfer/dissemination element of the project was to facilitate a closer working relationship between members of the CaBA community at a local, regional and national level, and to ensure that CaBA partnerships in urban areas are fully informed and engaged with the evidence and best practice approaches developed during this project.

By disseminating best practice through the urban catchment management ‘community of practice’ this project has promoted a more consistent and quantitative approach to targeting measure and assessing the cost-benefit realisable. This should therefore also help to ensure that opportunities for successful intervention and delivery of real improvement in ecosystem services provision in urban landscapes are maximised. A further benefit we envisage is to deepen links between the catchment science, environmental economics and CaBA communities to foster better understanding and increase the impact and awareness of catchment management/ecosystem services interventions in urban areas.

There has been a strong emphasis throughout this project on drawing out best practice and disseminating outputs to key stakeholders through existing and new CaBA sub-groups and website. For example, the compilation of best-practice produced will be presented in a variety of accessible formats (film, presentations, case studies, documents) and disseminated through all available channels (CaBA Support, CaBA Urban Sub Group, Catchment Data User Group, CaBA website, other practitioner networks, Defra/EA/NE channels, The Rivers Trust, etc).

In addition, it is also important that the project is fully embedded within the Catchment Based Approach ‘communities of practice’ forming in partnerships throughout the country and under the auspices of the CaBA

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National Support Group and its sub-groups (esp. the Urban, Benefits Assessment and Catchment Data User Groups)

Key knowledge transfer deliverables produced include:

- A series of documented workshops and consultations to facilitate stakeholder input and co-design of processes and supporting tools for an ESS approach to urban catchment management
- An over-arching ‘how to guide’ for the participatory ESS approach to urban catchment management - including a participatory approach to ESS assessments, communications and use of supporting analytical and decision support tools. This will include sections or stand-alone papers on:
  - Principles and good practice in a participatory ESS approach to urban catchment management
  - the approach used for benefit appraisal including the handling and representation of ESS
  - the technical tools and data used to support the approach
  - informative illustrations of the pressures, pathways, receptors and ESS pertinent to the management and improvement of the urban water environment and its riparian zones
- A presentation and demonstration of the functionality of the ‘how to’ guide and accompanying technical tools available to support the guide.
- Incorporation of the above into existing open-access web-based platforms that are available to support the CaBA and other community groups
- A variety of public/stakeholder-facing communications materials in a number of formats designed to engage and raise awareness of the project and the issues surrounding ecosystem services in urban landscapes. These could include illustrations, a film, infographics, web/social media content and/or face-to-face presentation materials.
- A final summary report outlining the main findings and outputs from the study (Defra EVID4)

We have also developed a variety of presentation materials, which members of the project team and others have used to disseminate the approach and the detailed findings at a number of wider events as the opportunity arises, including the WRT National Catchment Science Conference, CaBA Defra Atrium day, Rivers Trust Spring and Autumn conferences, EU TRAP, WaterCAP and WaterLIFE conferences and other catchment/environmental management conferences (e.g. IEEM and /or CIWEM).

All of these outputs can be viewed via the Local Action Project website - <http://urbanwater-eco.services/>

### *2.6.1. Natural Value in Urban Landscapes – the Good Urban vs Bad Urban Graphic*

The Westcountry Rivers Trust have previously gained significant traction with local communities, stakeholders (including farmers) and local and national policy-makers, using an informative and engaging graphic illustration known colloquially as ‘Good farm – Bad Farm’. This image illustrates some of the challenges to the natural environment/ecosystem health and function posed by poor farming practices on one side and the potential for farm-advice and investment in on-farm measures to mitigate them on the other.

In 2012 the Westcountry Rivers Trust commissioned a graphic depicting an integrated vision for sustainable catchment management and ecosystem services provision. This graphic has also gained significant traction and serves as an excellent engagement and communication tool when attempting to explain how ecosystem services benefits can be realised within a catchment landscape and move through it to beneficiaries.

Keen to build on the success of these two graphics, Defra wanted to explore the potential for the creation of another illustration depicting the value of natural capital and environmental interventions in an urban landscape. This graphic would form just one element of the suite of engaging and informative resources developed and disseminated for the Local Action Project. It was hoped that a variety of end-users would be able to use this

graphic to inform their narrative about their urban landscape and so help them build consensus around a shared vision for the future.

A Cornish artist called Brian Hoskin was awarded the commission to create the illustration. He was provided with detailed information relating to the challenges and pressures acting on the urban environment and to all of the green-blue infrastructure and SuDS typologies that could be identified or created in urban landscapes.

The final illustration, shown below, has already been used extensively in the engagement and communication work of the Project Team, has been annotated to show the contextual considerations when designing GI/SuDS and is now a fully interactive guide to the urban practitioner's interventions 'toolbox' developed during the project.

In addition, the graphic is being used to explore the potential benefits of ecosystem service enhancement in urban areas with stakeholders and has been used to elicit responses from community members engaged in social research undertaken by WWF to examine public perceptions of the water environment (LINK).

Figure 26. The 'Natural value in urban landscapes' illustration (known colloquially as 'Good town – bad town').



### 2.6.2. Project Dissemination Activities

- The LAP was presented to the CaBA Urban Working Group debrief meeting following the 5x CaBA Urban Workshops (London, Manchester, Exeter, Leicester and Worcester) run under auspices of the Urban Demonstrator Project and WaterLIFE. Discussion included how the LAP outputs will be disseminated throughout the CaBA Community. Paul Shaffer (Ciria) has been using some of the LAP graphics already and is keen to meet with us to explore further collaboration in the future. Information about the LAP has been circulated to the 325 people who attended one of the CaBA Urban Workshops in March and April 2016 following huge interest in the project stimulated by the presentation of the project given at all of these events.

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- On 26<sup>th</sup> May 2016, the LAP is to be presented to staff from Defra and other Defra organisations at a dissemination seminar in Nobel House, London. The Simply Evidence event is to be hosted by the Floods & Water Research Team.
- The LAP is to be presented to a number of organisations and groups via a series of 1 hour webinars. These will include presentations to specialists from Natural England, the Environment Agency and the Ecosystems Knowledge Network.
- The LAP is to be presented at a number of high profile conferences, including the Ecosystem Knowledge Network's conference on 'Building Prosperous Cities: the role of natural capital and green infrastructure' in London (27th September 2016); the water industry's 5th annual WWT Integrated Water Resources Management Conference in (14<sup>th</sup> September 2016); the Westcountry River Trust (EA, CaBA NSG, South West Water) 2-day Integrated Catchment Management Conference (12-13th September 2016), and
- A number of carousel presentations were made to LIFE-IP Affiliates and CaBA Catchment Data User Group – this included many of the practitioners and stakeholders from the Manchester LAP Demonstration Area. Katherine Causer (EA Catchment Coordinator from the Irwell) has circulated the Manchester presentation to 67 partners from the Irwell.

## 3. DISCUSSION & NEXT STEPS

### 3.1. Next steps, future directions & opportunities

#### **On-going Collaborations and Work**

The key challenge for the Local Action Project team is to ensure that approach is operationalised and that it becomes an embedded part of the integrated catchment management work being undertaken in the UK. Perhaps the best way to achieve this will be to have the LAP approach incorporated into the Catchment-Based Approach or Defra 25-Year Environment Plan work programmes (which is likely to include a series of 'pioneer' projects).

As described previously, the LAP team are working with the CaBA National Support Group and its various working groups to ensure that the approach is integrated into the work of the CaBA Community. In addition, work is underway to engage the various organisations and groups involved in the Defra 25-Year Environment Plan and to explore ways that the approach could be incorporated into the work being done to develop best practice and learning to inform this process.

Other work that is ongoing includes:

- Having presented the LAP outputs to the Head of Planning and Deputy Mayor (and Portfolio-Holder for Planning) in Leicester City Council, the Deputy Mayor wants to showcase the work to the Mayor of Leicester and disseminate the approach throughout the Council.
- The LAP approach continues to be developed and disseminated in collaboration with the NERC Catchment Planning and Management Knowledge Exchange Fellow – Alex Collins. Alex is working with the WRT team prepare and submit two manuscripts relating to the LAP work for publication. These publications will focus on; 1) the development of the ESS Benefits 'Wheels' and opportunity mapping work, and 2) the social study undertaken using workshops, interviews and questionnaires to explore the barriers, challenges, opportunities and enablers confronting local practitioners (including Catchment Partnerships) attempting to deliver GI/SuDS in urban landscapes.
- The Institute of Environmental Analytics are committing 75 days to develop the LAP outputs into an engaging and interactive online visualisation, perhaps similar to <http://healthywaterways.org/report-card> (subject to IP agreement).
- Following the presentation of the LAP outputs to a workshop of Local Authority, CaBA and civil society groups in Manchester there has been a lot of interest in taking the work forward. As a follow-up to look at this, Martin Moss (Natural England) and Caroline Riley (Healthy Rivers Trust) have arranged a telecon on the 23<sup>rd</sup> May. Ideas to explore include the development of further target area scenarios for targeting delivery in Manchester, the use of the LAP outputs to inform a new Greater Manchester Green Infrastructure Strategy, the application of the approach to Liverpool (with its new city Mayor), the potential use of the approach/data by the Flood and Coastal Committee, and the adoption of the approach in other NW urban areas under LIFE-IP.
- Following the CaBA Urban Workshop in London, the LAP team has engaged the London Borough of Hammersmith & Fulham who have now introduced us to Transport for London. TfL may be interested in trialling the LAP approach for some work they are doing in London.
- Building on the positive feedback received from Southampton Council, Alex Collins is looking to apply the LAP approach to Southampton as part of an Imperial College MSc Research Project. This will serve as a very useful test of whether the methodological framework can be transferred into new locations.
- Alex Collins has been exploring the possibility to work with the Future Cities Catapult (see notes of meeting with Stephanie Bricker). In addition, we have been discussing whether the BGS GeoVisionary tool could be a way of disseminating and exploring the LAP outputs and also exploring ways of accessing and

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incorporating the extremely useful (but commercial) BGS data on SuDS suitability into the opportunity mapping process.

- We are continuing to work on ‘embedding’ the LAP outputs in the work of the CaBA National Support Group, Urban Working Group and Benefits Assessment Advisory Group (which Claire, Nick and Paul Bryson are now taking forward as part of a CaBA NSG Work-Stream under the auspices of Richard Cole, Chris Ryder and Damian). See CaBA Urban Working Group ToR included above. This work includes working with Thames 21 and Lewisham Council to develop detailed case studies (see below).

### Further Research and Development Ideas

- The collaborative development of the LAP approach undertaken so far needs to be evaluated and opportunities for improvement/adjustment identified. Feedback has been sought from local stakeholder involved in the project and stakeholders from across the urban catchment management community, but detailed workshops/interviews/questionnaires will be required to determine exactly what has worked and which elements need refinement going forward.
- Further work is required to explore how the LAP approach can be used alongside methods to engage primary stakeholders and to influence/respond to public perceptions/understanding. In particular, the outputs were intended to be used in visioning exercises with the general public, to help build support/ambition for action and to support the development of neighbourhood plans. The Good Town – Bad Town image has already been used by WWF to elicit responses from primary stakeholders in social research undertaken for the WaterLIFE Project, but the other outputs need to have their applicability in this process examined in more detail.
- The aim of the LAP was to develop a suite of resources, including a generic framework for the strategic valuation and targeting of natural capital/ecosystem service benefits enhancement, which could be applied to any urban landscape in the UK and at a variety of spatial scales. The framework could then be refined and tailored, via consultation with local stakeholders and with locally-specific data and evidence, to create a resource that becomes a powerful enabler for people attempting to deliver local actions in the urban environment. Key success criteria for the project were therefore the demonstration that the resources/approach developed can be up-scaled and/or transferred to new locations across the country at a variety of spatial scales.
- Integration of the approach into a whole-catchment approach for the strategic assessment and targeting of natural capital and ecosystem services enhancement. WRT has secured the services of a student studying for an MSc in Applied GIS at Southampton University. This student will be undertaking a 3/4 month research project looking at the creation of a whole catchment ecosystem services ‘master-plan’ that incorporates the WRT ESS Visualisation Framework and the LAP evidence. A key component of this will be to address the key research question of how (posed by the UK Water partnership and others) we can ‘budget’ or ‘partition’ ecosystem benefits experienced by people between the rural, urban and downstream (transitional and coastal) landscapes.
- We want to look at how citizen science and social/cultural ecosystem services could be developed and used in the method. In particular, we want to explore the use of Strava (or other App) data and social media data feeds to assess cultural ecosystem services value in urban landscapes.
- Alex is exploring the potential for NERC’s research on ecosystem services for poverty alleviation could be applied to social deprivation in the global north.
- We are looking to develop a project that will make use of Q method for interviewing and reviewing literature from different actors in the urban environment. This will tie in with our continuing work to develop comprehensive, cost-benefit assessed and multi-perspective narrative case studies that explore not only the technical aspects of projects (such as the lessons learnt, the wins and the losses), but also the "mindsets" of different groups of people involved (receiving community, practitioners, stakeholders) and their perspectives on what happened.

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- We are continuing to explore (with the Catchment Data User Group) the issues of data availability for local natural capital assessment. In particular, we are looking at the challenges faced when attempting to obtain data from Local Record Centres, NERC institutions, academic studies and (although much less of an issue now) government agencies.
- One critical further area of investigation is the relationship between this work and the management of groundwater resources. There are some very useful datasets available as commercial products from the British Geological Survey, which relate the potential or otherwise of infiltration SuDS installation, and these should be obtained at some stage and incorporated into the opportunity mapping and scenarios proposed by the LAP outputs. Groundwater vulnerability (water resources and quality) is a very important consideration when designing any intervention in urban landscapes.

## 4. FURTHER INFO & CONTACTS

More information and all of the principal project outputs can be found at the project website <http://urbanwater-eco.services/>

Please contact Alex Collins, Imperial Collage ([Alexandra.Collins@Imperial.ac.uk](mailto:Alexandra.Collins@Imperial.ac.uk)), Nick Paling, Westcountry Rivers Trust ([nick@wrt.org.uk](mailto:nick@wrt.org.uk)) or Ashley Holt, Defra Water ([Ashley.Holt@Defra.gsi.gov.uk](mailto:Ashley.Holt@Defra.gsi.gov.uk)) to find out more about the Local Action Project.

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## 6. APPENDICES

## 6.1. Appendix 1

# Developing an Ecosystem Services Approach for the Urban Water Environment

## Urban Environmental Practitioner Questionnaire

1. **Name:**

2. **Organisation:**

3. **Operational area:**

*Please include a map or catchment description if appropriate*

4. **Are you a delivery organisation, regulator, strategic body, academic, policy-maker, stakeholder group (a 'civil society' group) or another (please state)?**

*Please describe the remit of your organisation*

5. **Along what geography is your operational area defined – is there a difference between your area of interest and your operational/delivery area?** Does your operational area sit within a wider functional/management unit (e.g. a larger upstream catchment or landscape area)? How do you feel your area interacts with this wider area (whatever the scale) and how do you describe this to your stakeholders?

6. **Do work exclusively in urban areas or does your field of interest/area of interest/delivery area cross into the suburban/rural landscape?** If you do work in both areas, do you adopt different approaches in these areas or the same approach? Please describe how you perceive the different challenges that exist when working in rural and urban landscapes.

7. **In delivering your work to enhance the environment, please tick which one or more of the following statutory/regulatory frameworks do you operate in and add any comments about each one (specific areas, reasons, barriers, opportunities, etc)**

- The planning process (NPPF, Local Plans, Regional Spatial Plans, Section 106, Biodiversity Offsetting, developer-led EIA/protected species);

- Biodiversity & conservation (Biodiversity 2020, Species & habitats, greenspace provision);

- River health, water quality and ecology (Water Framework Directive, drinking water provision, Bathing Waters, TraCs, etc);

## Defra - Local Action Project

Type here...

- Water resources management (drinking water provision, flood risk management, urban drainage, CSOs/waste water);

Type here...

- Green and blue infrastructure (recreation, leisure, aesthetics, access, culture, society, health & wellbeing).

Type here...

- Or is it more than one of these and you tailor your language and approach depending on who the target audience is...?

Type here...

- 8. When you are planning your work, how do you identify possible locations in which to deliver your interventions?** For example, do you generally focus on new development, brownfield sites, retrofitting GI, greening the urban landscape or green/blue space enhancement/restoration...?

Type here...

- 9. Once you have found potential locations or sites to work in, do you perform any form of prioritisation on them to decide where to work first – perhaps based on perceived or recorded need...? Or do you try to take opportunities as they arise or go to the one with the greatest feasibility, least cost or with favourable collaborations/amenable partners..?**

Type here...

- 10. Do you consider the current level of benefits/environmental services currently being provided to people in a specific area when deciding whether or not to work there?**

Type here...

- 11. Please can you list the interventions that you have the capability to deliver and which of these you have delivered over the last 5 years? Are there others that you would like to deliver in the future? We want to understand the 'toolbox' of interventions you have at your disposal.**

Type here...

- 12. What criteria do you evaluate when considering the various interventions available and which do you consider most important (e.g. cost, function, benefits, opportunity, need, multifunctionality)?**

*Please rank these from 1-not important through to 10-very important.*

Type here...

- 13. When you are working in a location or have found a site (an opportunity presents itself), how do you decide what intervention/s to deliver into it? Do you go for off-the-shelf solutions or does each site have a solution tailored to the benefits needed and an assessment of feasibility? Do you consider the variable costs incurred depending on what is delivered and by whom?**

Type here...

- 14. When you are planning your work in urban areas, do you consider the ecosystem services that you are trying to enhance?** How do you quantify/estimate/predict the benefits that could result from your proposed intervention? Do you consider the variety and/or magnitude of the benefits that might be realised by the different options and do you consider the trade-offs/compromises that may have to be made...?

## Defra - Local Action Project

Type here...

15. Do you undertake monitoring and/or evaluation of any kind to determine the impact of your work (whether environmental, social or economic measures)? Or, do you rely on 'proof of concept' information produced by other people (if so, who, what info and what methods have been used)?

Type here...

16. Have you had (or do you know of) any proposed urban schemes that failed to come to fruition. Please explain why they failed and what, if anything, you could have done differently to get a better outcome..?

Type here...

17. What methods do you use to engage with policy makers, LAs, developers, .govs, stakeholders and the public to explain the benefits and trade-offs of your proposed scheme and the various solutions available..?

Type here...

18. Have you developed (or do you know of) any good examples of communications tools/ resources/media/publications that have been used to engage with policy makers and/or stakeholders and empower them to make better, more robust decisions about environmental work in urban areas?

Type here...

19. Does the choice of intervention affect how the work is funded and who funds it? Are there interventions that some organisations won't fund or places they won't work in? Or does it just come down to the language you use and the effectiveness of your 'pitch'..?

Type here...

20. What 3 policy, regulatory, institutional or behavioural changes would you recommend be made in the UK to make it easier for urban environmental projects to delivered?

1.  
2.  
3.

21. Can you provide a list of examples or case studies of environmental projects or initiatives undertaken in urban areas (please state where) that you have been involved in or that you are aware of and that you think could be useful in helping others who want to work in urban areas. Please include any case studies or examples that involve engagement/comms/education, research, strategic planning, targeting, delivery of interventions, or outcome/benefits assessment. Please include examples undertaken at any spatial scale, no matter how

Type here...

*Thank-you very much for your time spent completing this questionnaire. All information gathered will be compiled and presented to the CaBA Urban and Benefits Assessment Working Groups.*