INVEST IN ARUP

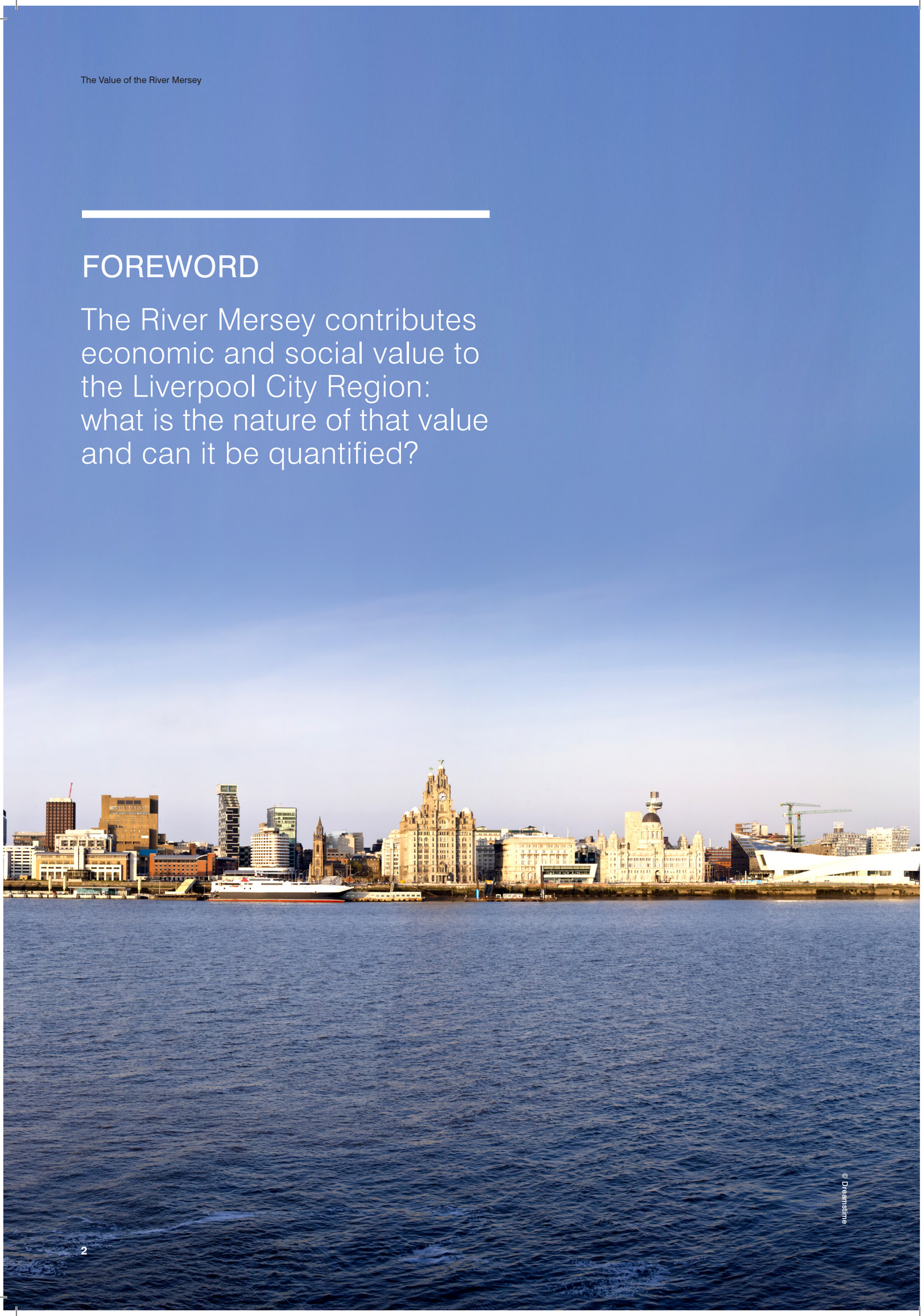
THE VALUE OF THE RIVER MERSEY

An appraisal using an ecosystem service-led approach

2 | 28 April 2016

FOREWORD

The River Mersey contributes economic and social value to the Liverpool City Region: what is the nature of that value and can it be quantified?



Contents

Tables

Figures

Appendices

(not included in printed, bound version but available separately from Arup)

EXECUTIVE SUMMARY

The aim of this research is to identify and, as far as possible, quantify many of the crucial but hidden environmental assets that are derived from the River Mersey to the Liverpool City Region (LCR). The assessment part of the work is based on an approach founded in environmental economic theory known as the 'ecosystem service approach'.

Natural capital and ecosystem services

In natural capital assessments, the environment[1] is viewed as a stock of goods and services, which produce value for society, individuals or organisations. Ecosystem Services (ES) are usually defined as the benefits people obtain from ecosystems. ES flow from natural capital stocks and are typically classified into the following categories:

- provisioning e.g. drinking water or fish
- regulating: e.g. flood risk protection, CO2 storage and sequestration and pollution filtration
- cultural e.g. recreation, water sports and bird watching.

In addition, there are **supporting** or underpinning services which are critical to the delivery of other ecosystem or total services (outlined above). These include nutrient recycling, primary production and soil formation.

An ecosystem services-led approach offers a pragmatic, rational approach to natural resource management that is familiar to economic analysts. The present study sought to provide improvement of knowledge on ES associated with the Mersey, highlighting knowledge gaps and pooling existing evidence relating to specific themes, where appropriate.

Value of the River Mersey

The River Mersey is clearly a significant presence throughout the LCR, both environmentally and economically. A qualitative appraisal was undertaken to describe the value of the River Mersey using the Total Economic Value (TEV) framework. The purpose of this exercise is to isolate the individual benefits so that they can be examined individually, understood and aggregated for future assessments.

In many cases there would be no value created without the natural capital asset, but equally, no end value could be realised without human creativity, investment or time. This is true across a range of areas, from local mental health to the national economic contributions from the port.

[1] Environment here can be anything – a field, a national park, a river catchment, a lake, a city park, private gardens.

The socio-economic benefits provided are complex and numerous, and there are clear interdependencies, conflicts and potential trade-offs. A summary of the types of values from the Mersey are outlined below, by stakeholder type or group.

Agricultural and food business

Over half (58%) of Merseyside is designated as 'rural, with 600 farms operating in the area. In addition, the River Mersey also contains an area of edible shellfish harvesting of around 870 hectares. These businesses and sectors are inherently linked to the River Mersey. They obtain naturally occurring products and through human endeavour, generate value. They also receive economic benefits from the environment through a series of regulating services, which ensure land is resilient to natural hazards and pests, and assimilates pollutants.

Water dependent business

This group of stakeholders depends on the river, either for water supply or its ability to remove/dilute pollutants; this includes the ability to take large quantities of water for disposal.

Business dependent on navigation

Businesses which depend on navigating the Mersey include companies situated on the docks, and those in-land which are dependent on materials brought into the LCR via the docks. They generate value through the combination of natural, human and economic capital. The Port of Liverpool is the most important UK deep sea container port for container services between Great Britain and North America and is ranked 7th in the UK in terms of total tonnage. Liverpool Marina is located just outside the city centre and is a leisure boat mooring site, with 350 permanent berths, and various other leisure facilities.

Employees across all sectors linked to environment

Livelihoods and the prosperity of many individuals and households will be dependent on the jobs supported by the river. The value of being in employment is different to the value an employee provides for a company or an economy. There is security associated with being in employment, and people in work have the freedom to make choices they may be denied by unemployment. This factor is outside the scope of this study, but has a social and economic value and could be an area for future research.

Recreation

The LCR has a strong visitor economy and a proportion of all visits (including visitors drawn locally and nationally) will be linked to the river, either in part, or entirely. Significant attractions, such as the Maritime Museum and Albert Docks, occur across the LCR and draw in visitors from many different areas. There are large numbers of other smaller recreational users along the Mersey which will also draw visitors from outside the LCR.

Residents of the LCR

The total population of the LCR is approximately 1.5 million people. Residents, particularly those who have lived for a long time near to the river, will have a cultural connection to it, and may occasionally use the river environment for recreational activities.

Residents near to river

This group of stakeholders will obtain a number of benefits from the river. They will have more frequent interactions with the river than the wider LCR population (for example through views or recreational use), and may be more dependent on the regulating services it provides (e.g. flood event regulation). Within the Mersey Corridor, it is estimated that 230,000 residents of the LCR live near to the river.

Value of Natural Capital from the River Mersey is £348 - £400 million/year across the Liverpool City Region. If extended to the whole catchment we think this value will be well in excess of £1 billion per year.

Rest of the UK

The rest of the UK benefits from avoided health spending associated with certain services provided by the Mersey and the surrounding environments. This can relate to its ability to assimilate air pollutants and the associated avoided health costs (which would require central government spending). Equally, there is an avoided cost associated with the unemployment support, which is not paid because of jobs supported by the river.

Global society

The "global society" benefits from the carbon sequestered by the Mersey and its surrounding environments. Different environments associated with the river will sequester carbon at different rates.

Conclusions and recommendations

Devolution and maximising value

The devolution agreement states that Liverpool City Region will commit to the cleanest river standards by 2030 and commit to a discharge-free Mersey by 2040. This commitment will help ensure that the socio-economic value potential of the river is achieved. This research has presented a breakdown of value accruing to certain stakeholders, and from different perspectives, starting with a TEV approach, and building on this through use of an ecosystem services framework. Consideration of value across all the environmental goods and services presented can help in realising optimum (i.e. maximised) value.

Future interventions on the River Mersey could be appraised using the ecosystem service framework, to understand how values for certain stakeholders may increase or decrease. This can help in shaping plans and projects to ensure that the potential of the River Mersey is realised and that overall no stakeholders lose out.

This research presents a series of stakeholders and a framework for use in such an appraisal.

Intrinsic value

The river has an intrinsic value, which is not necessarily linked to the human-focussed socio-economic values discussed throughout this report. Any future studies or interventions which concentrate on value, should have regard for the river's intrinsic value, to ensure economics does not over-ride aspects such as biodiversity (in its own right, not just for human enjoyment) or landscape.

Further study

Further study could be focussed on certain areas where knowledge is low or non-existent (e.g. tourism and the river or deprivation and the river), across everything highlighted in this report, with the intention of providing a more accurate quantitative understanding. Should this go ahead, a multidisciplinary approach is recommended, drawing in expertise from environment, economics, ecology and local experts. The geographical scope should be extended to the wider River Mersey Catchment to cover key issues such as carbon sink through land-use, e.g. forestry.

Governance

If a strategic total economic value view of the River Mersey is to be considered in future decisions, there is a need for strategic governance i.e. a body or individual responsible for considering the total economic value of the river. Such a body or individual should be charged with attempting to represent the viewpoints of all stakeholders who derive value form the river.

The River Mersey Task Force is in a unique position to take on this role, or advise any future custodian of this role. This is furthered by the opportunities under the LCR Devolution Agreement, which present the opportunity to bring the River Mersey Task Force, the LCR Combined Authority and wider stakeholders together as a unified partnership to deliver the River's full potential.

Traction and investment

The overarching aim of any next steps should be to deliver positive results of the River Mersey, and those who derive value from the goods and services which emanate from it. The value of the river needs to be communicated clearly to gain traction at the highest political level. As such, the case for investment in the river needs to link to the agendas which face the City Region. Specifically these might include:

- Devolution – as outlined in Section 6, the river has a significant role to play in the future of the City Region.
- Inequality and deprivation – the City Region has some of the highest levels of deprivation across most domains.
- Jobs and growth – translates into above average levels of people in receipt of Job Seekers Allowance (JSA) and other benefits. Particularly impacted upon are young people with above average levels of youth unemployment and also long-term youth unemployment.
- Catchment management – many of the benefits described are commonplace across the whole catchment. This type of thinking ought to be employed across the wider catchment(s) associated with the River Mersey.

Further consultation

The River Mersey Task Force wishes to enter into dialogue with the LCR Combined Authority to agree the scope and activity needed to implement the devolution agreement. In addition, further study should include targeted consultation with the identified stakeholders.

The devolution agreement states that Liverpool City Region will commit to the cleanest river standards by 2030 and commit to a discharge-free Mersey by 2040. This commitment will help ensure that the socio-economic value potential of the river is achieved.

1 INTRODUCTION

1.1 What is the value of the River Mersey?

The above question is the starting point for this study. The ultimate aim of this research is to identify and, as far as possible, quantify many of the crucial but hidden social and environmental benefits that are derived from the River Mersey to the Liverpool City Region (LCR).

The research task is to identify value from a number of different perspectives. The intention is to provide – within the constraints of available information - an account of the total value, contributed by the River Mersey, to different groups/individuals (stakeholders), across the Liverpool City Region (LCR).

The assessment part of the work is based on an approach founded in environmental economic theory known as the 'ecosystem service approach', the results of which are initially presented in a framework format. This forms a useful starting point for structuring further debate, facilitating discussions and analysing trade-offs between the many benefits arising from the River Mersey

The study aims to improve and consolidate knowledge of the Mersey's value, whilst highlighting knowledge gaps. In addition the study aims to identify opportunities for maximisation of societal and economic value. It is the intention of the River Mersey Task Force (FMTF) to develop this approach informed by discussion with key stakeholders, and in due course extend the framework approach to the River Mersey catchment.

1.2 Structure of the report

The report is structured as follows:

- Section 2 sets out the regional context, explaining the setting for the study
- Section 3 outlines Natural Capital theory, with a brief introduction to the concepts which have driven this research
- Sections 4 and 5 define total economic value using qualitative and quantitative appraisal techniques.
- Section 6 contains discussion and potential next steps.

In addition to the above, two appendices of research are available from Arup but not included in this bound version which cover an overview of the environmental and socio-economic conditions (Appendix A and Appendix B).

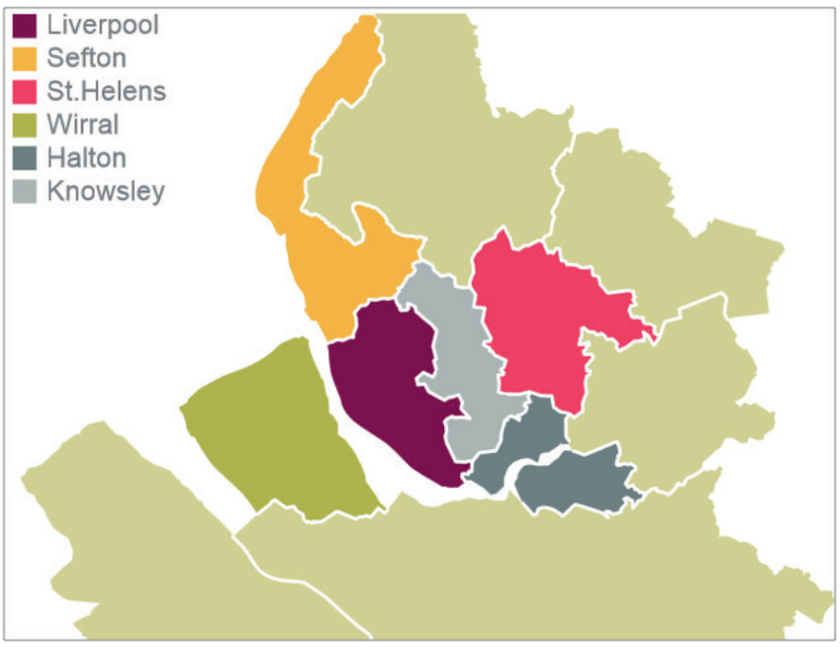
The study aims to improve and consolidate knowledge of the Mersey's value, whilst highlighting knowledge gaps

2 REGIONAL CONTEXT

2.1 Liverpool City Region

The Liverpool City Region (LCR) comprises the Boroughs of Liverpool, Halton, Knowsley, Sefton, St Helens, and Wirral regions with a zone of influence extending into North Wales, Cheshire, Lancashire and Warrington. In terms of economic activity, the LCR consists of 1.5 million people; 40,000 businesses and 625,200 employees[2]. The LCR is regarded as one of the major economic drivers of the Northern Powerhouse concept, and is currently negotiating its own devolution deal. The extent of the LCR is outlined in Figure 1.

Figure 1: The Liverpool City Region (Source: Wikimedia Commons[3]).



2 Liverpool City Region Devolution Deal Submission to the Comprehensive Spending Review, 2012: https://www.liverpoollep.org/wp-content/uploads/2015/09/Liverpool-City-Region-Devolution-CSR-Submission-September-2015-2.pdfs

3 https://commons.wikimedia.org/wiki/File:Merseyside_County.png

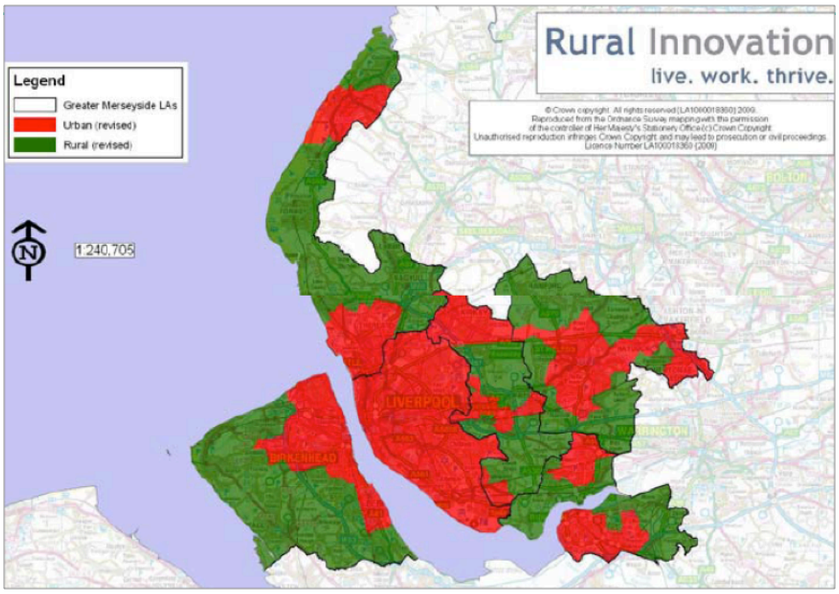
Major employment and innovation sites are located across the city region, including the port within Liverpool, Science and Innovation Park at Daresbury and Liverpool Knowledge Quarter which includes world leading centres of excellence such as the Liverpool School of Tropical Medicine and the Oceanography Institute.

Leisure and tourism is a large contributor to the economy. Significant contributors include:

- England's Golf Coast – hosting major events at Royal Birkdale & Royal Liverpool, including The Open.
- World-famous attractions such as the Lady Lever Art Gallery in Port Sunlight, the Mersey Waterfront (the Three Graces),and Knowsley Safari Park.
- Iconic public art - Another Place and Dream.
- Many miles of accessible coast and seaside resorts in Sefton and Wirral.

Despite its urban image, some 58% of Merseyside is designated as 'rural' (Figure 2), with 600 farms and horticultural businesses, managing more than 20,000 hectares of Merseyside. One in three businesses are based in the rural areas, hosting 22% of employment and generating 22% of Merseyside's economic wealth[4].

Figure 2: Rural and urban areas across Merseyside



[4] The Merseyside Rural Economy Action Plan

Natural assets for green energy generation include onshore, offshore and coastal wind resources, biomass, biogas, tidal stream/change and solar power. Merseyside Rural Economy Action Plan states that approximately 2,600 hectares of new woodland have been planted in the last 20 years. This constitutes enough potential biomass from forestry management to heat 2,800 homes. The contribution of the natural environment to socio-economic welfare is likely to be significant, but, as yet, is not fully appreciated or evaluated.

The principal natural asset at the heart of the LCR is, however, the River Mersey and its associated environments. It is central to the area's cultural heritage and international profile, and is linked directly to the economy and day-to-day lives of the people who live, work and play across the LCR.

Natural assets for green energy generation include onshore, offshore and coastal wind resources, biomass, biogas, tidal stream/change and solar power. Merseyside Rural Economy Action Plan states that approximately 2,600 hectares of new woodland have been planted in the last 20 years.

2.2 The River Mersey

The River Mersey drains an area of 4,680 square km, from the Pennines to the Irish Sea, taking in all of Merseyside and Greater Manchester, most of Cheshire and parts of Lancashire and the High Peak District.

The Mersey Basin provides a network of natural environmental components and green and blue spaces which provides multiple social, economic and environmental benefits.

A significant range of initiatives has been implemented over several decades, to harness the River Mersey as a conduit for economic and social regeneration.

Recent history and management of the river

From the 18th Century onwards, the Mersey became the world's connection to the industrial revolution, and as a consequence water, land and air – the natural environment - were exploited and degraded. In 1983, Michael Heseltine, the then Secretary of State for the Environment (dubbed the 'Minister for Merseyside'), declared the River Mersey to be "an affront to modern society" and suggested that "a Mersey Basin restored to a quality of environmental standards fit for the end of this century will be of incalculable significance in the creation of new employment."

Hence, in 1985, the Mersey Basin Campaign (MBC) was born, with the aim to repair the damage done to the region's rivers by industrialisation, and encourage waterside regeneration through community involvement and partnership. The MBC closed its doors in 2010 following a structured period of wind-up and succession planning. The outstanding legacy of the MBC is the River's transformation to a world class River.

Whilst the MBC was the keystone in terms of improving the water quality of the rivers and streams and regeneration of the waterside, providing good water quality - a prerequisite for the task of regeneration; two other strategic programmes, the Mersey Waterfront Regional Park (MWRP) and the Mersey Estuary Management Plan (MEMP) continued and accelerated the positive impact of the MBC:

- The role of the MWRP was to stimulate the region's economic growth through the regeneration and redevelopment of the waterfront, with some prestigious projects successfully boosting the visitor economy and public realm for visitors and local communities alike. One particular feature of the MWRP was the 'Windows on the Waterfront' concept which brought together hubs of activity/diversity and investment opportunity. This introduced a spatial dimension to the MWRP with each 'window' reflecting different features/ characteristics of the waterfront landscape.
- The MEMP provided a much needed framework to integrate activity, investment and policy. Its vision and objectives continue to provide a relevant framework for continuing work on the estuary today. Much of this organisation competence, skills and knowledge still resides within the Liverpool City Region.

Added to this, the Leahy and Heseltine Report - 'Rebalancing Britain: Policy or Slogan?' identifies the unique potential of the River Mersey and Atlantic Gateway area to rebalance the economy between the north and south of the country. The report states that improving the Mersey would enable 'Liverpool to make a major contribution to the country as a pioneer of greener, more

The Mersey Basin provides a network of natural environmental components and green and blue spaces which provides multiple social, economic and environmental benefits.

From the 18th Century onwards, the Mersey became the world's connection to the industrial revolution, and as a consequence water, land and air – the natural environment - were exploited and degraded.

sustainable and more prosperous urban living.' It also draws on the excellent work and foundations of previous initiatives including the Mersey Basin Campaign. Through negotiation of the LCR Growth Deal this developed into an objective to convene a Task Force to examine "the feasibility of the River Mersey becoming the cleanest and most ecologically diverse river in an urban setting by 2045".

The Task Force believe that at the heart of this vision is the desire to further examine the economic potential of the River and its environs including the great cities of Liverpool and Manchester. Three inter-related concepts support this belief (i) make the most of past investments in the Mersey, (ii) ensure that the River and its environs are clean, litter free, respected and well managed and (iii) create conditions that the area becomes the preferred northern location (the so called Northern Powerhouse) for strategic infrastructure investment and sustainable economic growth beyond the Atlantic Gateway and catchment of the Mersey.

The Task Force prioritised the following three areas which now need to be re-examined within the contact of the Liverpool City Region Devolution Agreement:

- Unblock barriers to sustainable economic growth at key locations around the River Mersey.
- Unlock economic potential – Create opportunities to use the River Mersey to drive innovation, collaboration and development across key sectors including renewable energy, water innovation, water resource management and the visitor economy.
- Deliver a long term sustainable economic growth plan for the River Mersey – Working at a wider geographic scale, collaborate, prepare and implement a River Mersey Growth Plan to unlock economic potential.

Atlantic Gateway Partnership

Established with its very clear mission to accelerate growth across the North West of England, it encompasses the two cities of Liverpool and Manchester, linked by the Mersey and the Manchester Ship Canal.

The business-led partnership focuses its priorities on: growth, connectivity, infrastructure and sustainability. Water is central to delivery of these themes, by enhancing the environment, unleashing economic opportunity and regenerating communities.

The River Mersey Task Force

In 2012 the City Region Deal including an initial objective "To examine whether the River Mersey can become the cleanest and most ecologically diverse river in an urban setting by 2045, with the commensurate economic benefits." The Task Force then reviewed this and refine it into three integrated priorities:

- Unblock barriers to growth at key locations around the River Mersey.
- Unlock economic potential – Create opportunities to use the River Mersey to drive innovation, collaboration and development across key sectors including renewable energy, water innovation, water resource management and the visitor economy.
- Deliver a long term sustainable economic growth plan for the River Mersey – Working at a wider geographic scale, collaborate, prepare and implement a River Mersey Growth Plan to unlock economic potential.

Critically there is an understanding that the transformation of the Mersey will bring added opportunity and increased asset value to the communities and businesses within the wider catchment. A growing body of evidence indicates that successful cities are characterised by quality environments, public realm and attractive hinterlands, which are vital to economic regeneration.

2.3 Natural asset valuation

Economic evaluation of natural assets can be a helpful tool for determining options for the development of land at all levels. It can help provide an estimation of values for non-market goods such as climate adaptation or cultural benefits. Such appraisals can be qualitative in nature, or the results can be used in cost-benefit analyses to guide land use decisions in a defined area. This study uses a concept known as **Total Economic Value** to explore the value of the Mersey, and this is introduced in the next chapter of this report. We have used available information as the evidence base as part of this desk-based review. No primary data has been collected at this preliminary stage.

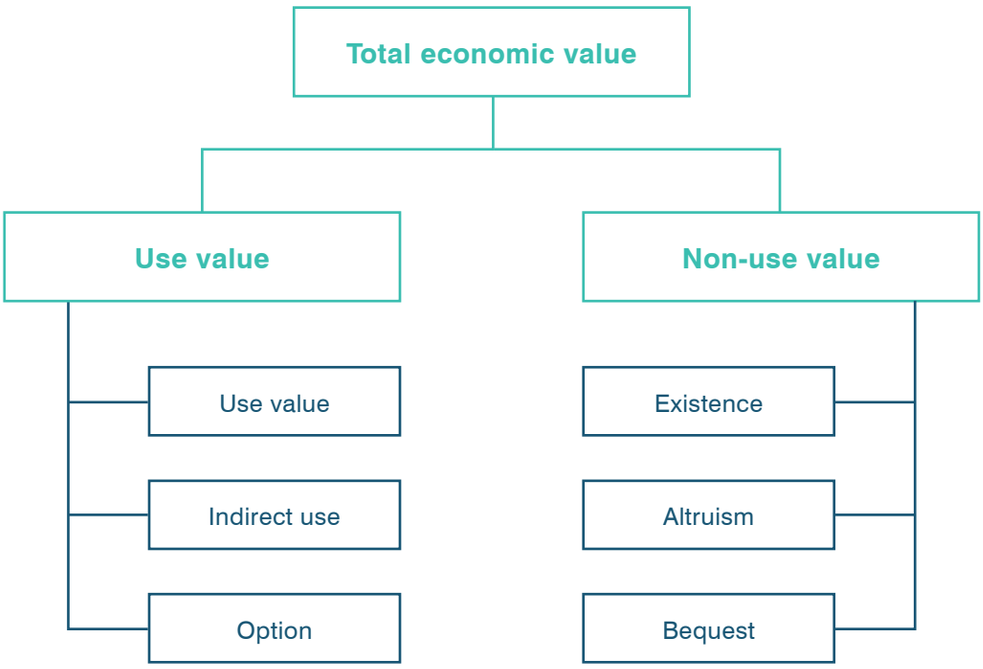
3 NATURAL CAPITAL CONCEPTS

3.1 Total Economic Value (TEV)

The TEV framework can be applied to any asset, environmental or otherwise - enabling assessors and decision-makers to avoid "partial valuation". In the TEV framework, values are broken down into two components; use and non-use values, and within these there are a number of sub-sets (Figure 3 below) which capture value from a number of different perspectives.

For use values these subsets include direct use, indirect use and option values. For non-use values the subsets are more conceptual, including the value from knowing an asset exists (existence value), the value of knowing others might benefit from an asset today (altruism) and the value of knowing that future generations will derive future benefit (bequest).

Figure 3: Total Economic Value (TEV) framework



3.2 Intrinsic value

The TEV approach (and the Ecosystem Services approach applied throughout this document) does not take into account the intrinsic value of nature, or nature's value in its own right. This can be highly subjective to certain policy aims and objectives, and is disputed by certain stakeholders. Ultimately, the point of discussion is value, and value is a human construct, which is analysed from a human perspective.

This does not imply that the intrinsic value of an area should be discounted from analysis, and this concept is discussed further in Section 6 of this report. Therefore value in the report is an under-estimate.

3.3 Natural capital and ecosystem services

It is often stated that the terminology associated with natural capital can be confusing. The terms capital, natural capital and ecosystem services are defined below.

Capital in economics is a general term used to describe assets used in production, to produce value for their owners. Equally, "capital" may be seen as a stock of assets, such as a premises and all the machines within it. Capital assets produce very specific services for their owners.

Natural Capital is an extension of the above definition. In using this term, the environment[5] is viewed as a stock of assets, which produce value for society, individuals or organisations. The Defra website cites the Natural Capital Committee's definition:

Natural capital refers to the elements of nature that produce value (directly and indirectly) to people, such as the stock of forests, rivers, land, minerals and oceans. It includes the living aspects of nature (such as fish stocks) as well as the non-living aspects (such as minerals and energy resources). Natural capital underpins all other types of capital (manufactured, human and social) and is the foundation on which our economy, society and prosperity is built.

Ecosystem Services (ES) are usually defined as the benefits people obtain from ecosystems. ES flow from natural capital stocks and are typically classified into the following categories:

- **provisioning** e.g. drinking water and fish
- **regulating**: e.g. flood risk protection, CO2 storage and sequestration and pollution filtration
- **cultural** e.g. recreation, water sports and bird watching

In addition, there are **supporting** or underpinning services which are critical to the delivery of other ecosystem or total services (outlined above). These include nutrient recycling, primary production and soil formation.

ES assessment literature typically recommends a framework approach. Frameworks allow assessors to work through all the potential ES an environmental resource may deliver, to help systematically understand and conclude which services are most relevant.

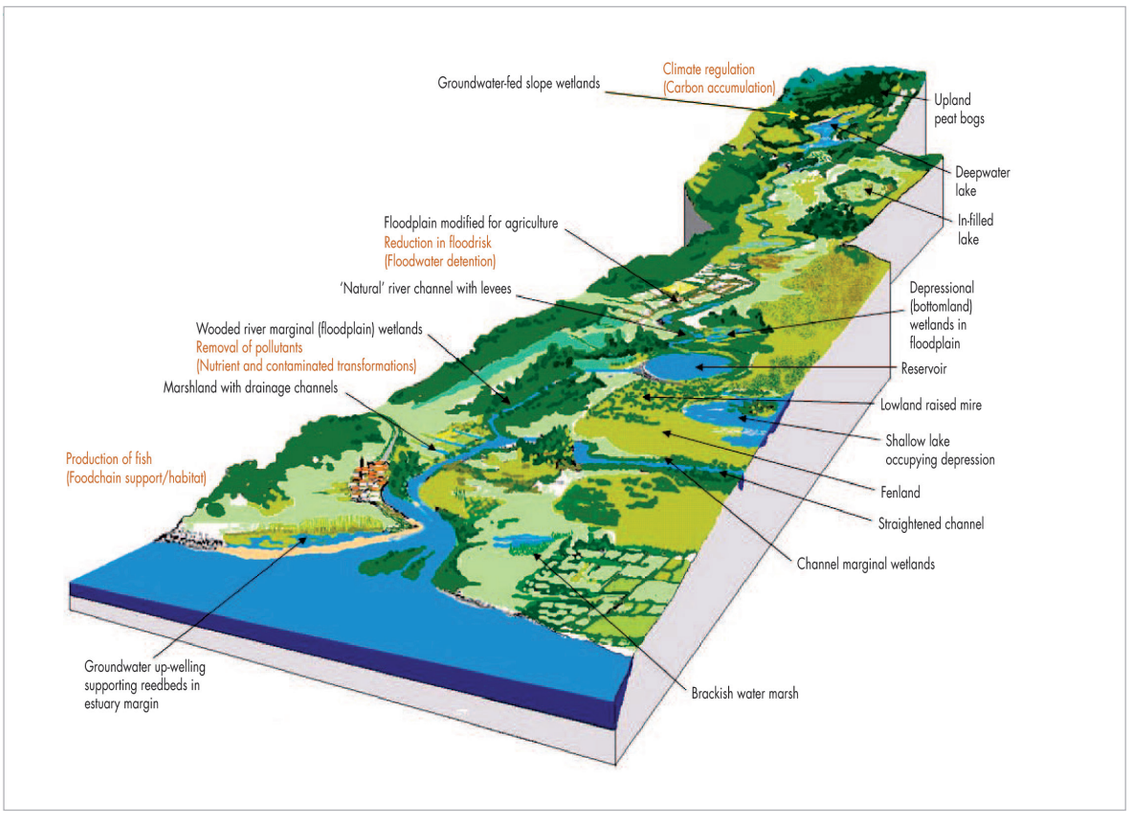
An ecosystem services-led approach offers a pragmatic, rational method to natural resource management that is familiar to economic analysts. The present study will provide improvement of knowledge on ES associated with the Mersey, highlighting knowledge gaps and pooling existing evidence relating to specific themes, where appropriate.

[5] Environment here can be anything – a field, a national park, a river catchment, a lake, a city park, private gardens.

3.4 Typical ecosystem services from rivers

Figure 4 and Figure 5 illustrate some of the typical ecosystem services associated with rivers, including: food production, building materials, navigation, health products, flood/flow/water quality/ fire regulation, human health regulation and a range of cultural services such as science and education, religious connections, recreation, sense of place and history.

Figure 4: Links between landscape location and wetland ecosystem services. Labels in orange are indicative of the functional gradient in importance of wetland ecosystem services, with text in parentheses providing an indication of the underpinning processes/ intermediate services. [6]



[6] Taken from the UKNEA, Chapter 9: Freshwaters – Open waters, Wetlands and Floodplains (Lead Authors: Maltby and Steve Ormerod)

Figure 5: Ecosystem services provided by the Freshwater Broad Habitat. Component and sub-component habitats potentially delivering ecosystem services are river (R), lake (L), pond (P), grazing marsh (GM), reedbed (RB), fen (F), and lowland raised bog (LRB).

Final services of Freshwater habitat	Habitats potentially delivering services							Conditions or characteristics of habitats required
	R	L	P	GM	RB	F	LRB	
Provisioning								
Fish	•	•	•	•				Commercially significant fisheries (crayfish, salmon, trout) based on rivers, lakes and ponds in suitable conditions.
Dairy and beef				•		•		Wetland grasses provide grazing, silage and hay. Nutritional level depends upon management.
Reeds, osiers and watercress	•	•	•	•	•	•		Reeds grow in saturated soils and slow flowing or still water up to 0.3m deep. Osiers produce withies for basket making requiring saturated soil conditions. Cress-beds need swiftly flowing high pH clean water.
Water	•	•	•		•	•		Open water habitats provide a water source for public supply, irrigated crops, power station cooling, industrial processing and fish farming, but high evaporation rates may suppress total water availability.
Peat		•	•	•	•	•	•	Peat provides the basis of some composts for horticulture. Peat needs to be >0.5 m deep to be commercially exploitable due to recent planning guidance.
Navigation	•	•						Navigable waterways need sufficient water depth and low velocity.
Health products	•	•	•			•		Mineral spas, medical plants (eg.bogbean), medical leeches
Regulating								
Carbon regulation		•	•	•	•	•	•	Carbon accumulates where production of plant litter exceeds decomposition and generally under waterlogged, predominantly anaerobic conditions. Deposition of organic sediments within lakes, ponds and resevoirs is an important component of the carbon budget.
Flood regulation	•	•	•	•	•	•		Flood reduction relies on available water storage. Permanently saturated habitats with no storage may generate or augment floods.
Flow regulation	•	•	•	•	•	•	•	River flow, groundwater recharge influenced by landscape location, water storage characteristics and connection with other water bodies.
Water quality regulation	•	•	•	•	•	•		Freshwater systems can dilute, store and detoxify waste products and pollutants, however there are threshold levels and some systems may accumulate substances to toxic levels.
Local climate regulation	•	•	•	•	•	•	•	Temperature and humidity may be different within the habitat and without; degree depends on size. Important moist microclimates can develop.
Fire regulation	•	•	•	•	•			Open water bodies can act as natural fire breaks.
Human health regulation	•	•	•	•	•	•	•	Natural freshwater systems can increase well-being and quality of life if visually attractive and supportive of physical recreation. Mismanaged freshwaters can be sources of water borne diseases and disease vectors (eg. mosquitoes), but also sources of biocontrol agents.

Final services of Freshwater habitat	Habitats potentially delivering services							Conditions or characteristics of habitats required
	R	L	P	GM	RB	F	LRB	
Cultural								
Science and education	•	•	•	•	•	•	•	Lake, floodplain and mire sediment sequences contain paleo-environment archives and human (pre) history, artefacts that may be lost if disturbed or desiccated. Freshwater ecosystems are important outdoor laboratories.
Religion	•					•		Freshwaters are sites of historical baptism and religious festivals.
Tourism and recreation	•	•	•	•	•	•	•	Extensive recreational fisheries (game species and course fisheries depend on good habitat). Tourism depends on landscape appeal and iconic species, such as rare birds, flowers or amphibians. Good water quality and visual appearance required for natural swimming and boating.
Sense of place	•	•	•	•	•	•	•	Water is important in defining specific landscape character and features strongly in art and local culture. Literary and cultural identities embodied in distinctive landscapes such as Snowdonia, the Lake District, the Somerset Levels, Gwent Levels or the Norfolk Broads.
History	•	•	•	•	•	•	•	Freshwaters and especially wetlands have played a key role in human history and settlement since prehistoric times. Water is a recurrent feature at the heart of many historically important places, battlefields, territorial boundaries and many local folklore connections.
Supporting services								
Biodiversity	•	•	•	•	•	•	•	All freshwater habitats with open water: species depend on conditions such as, temperature, oxygen level, depth and velocity of water and area with suitable conditions. Some habitats may provide temporary habitat for fish (eg. for spawning), such as floodplains.

3.5 Value, financial return or privatisation

Valuation studies are often thought of as the starting point for privatisation, or intrinsically favouring economic benefits for individuals or businesses. This is incorrect. Any quantitative values used in analysis provide a means for describing social **welfare**. In economics, the term welfare relates to concepts such as well-being. Ordinarily, values are aggregated across a population to describe welfare from an environmental asset.

Quantitative valuation does not describe a financial return to a person or a group of people; equally, it is not a price tag on an environmental asset (a criticism which is so often levelled at this type of analysis).

Monetary units are used in analysis to provide an accepted method for comparing relative values – the outcome is, however, frequently expressed as a range of values rather than a specific figure.

3.6 Previous studies

In the report, Making the most of the Mersey: delivery of its growth potential (a proposal by the River Mersey Task Force, October 2014), the beneficiaries of the River Mersey are identified and are shown below. These beneficiaries are a useful starting point in understanding how value accrues to the LCR from the River Mersey.

Figure 6: Beneficiaries of the River Mersey (source: River Mersey Task Force).

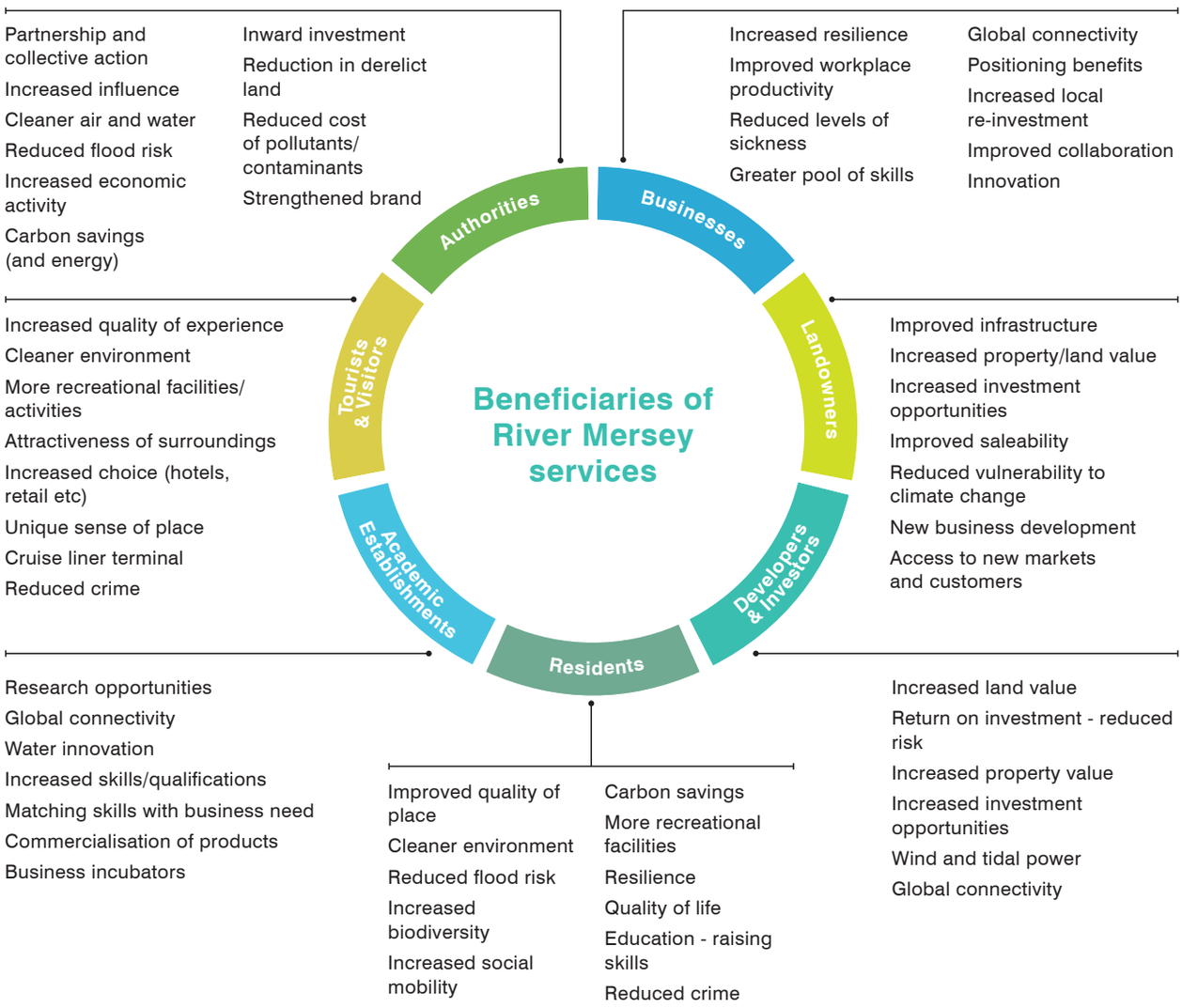


Figure 6 also identifies a number of clear synergies with the typical ecosystem service framework approach.

A review of the benefits cited by the River Mersey Task Force's study was undertaken as part of this study to understand which benefits link to specific environmental goods/services. This review is summarised in Figure 7 below.

The benefits with links to environmental goods and services were then mapped against a typical ES framework (Figure 8).

Figure 7: Benefits identified by the River Mersey Task Force which link to environmental goods/services.

Stakeholder	Identified benefit	Linked to an environmental good/service
Businesses	Increased resilience	Y
	Improved workplace	Y
	Productivity	?
	Reduced levels of sickness	?
	Greater pool of skills	N
	Global connectivity	Y
	Positioning benefits	?
	Increased local re-investment	N
	Improved collaboration	N
	Innovation	N
Landowners	Improved infrastructure	?
	Increased property/land value	Y
	Increased investment opportunities	N
	Improved saleability	Y
	Reduced vulnerability to climate change	Y
	New business development	N
	Access to new markets and customers	N
Developers and investors	Increased land value	Y
	Return on investment - reduced risk	?
	Increased property value	Y
	Increased investment opportunities	N
	Wind and tidal power	Y
	Global connectivity	?

Stakeholder	Identified benefit	Linked to an environmental good/service
Residents	Improved quality of place	Y
	Cleaner environment	Y
	Reduced flood risk	Y
	Increased biodiversity	Y
	Increased social mobility	N
	Carbon savings	Y
	More recreational facilities	Y
	Resilience	Y
	Quality of life	Y
	Education - raising skills	Y
	Reduced crime	?
Academic Establishments	Research opportunities	Y
	Global connectivity	Y
	Water innovation	Y
	Increased skills/qualifications	N
	Matching skills with business need	N
	Commercialisation of products	?
	Business incubators	?
Tourists and visitors	Increased quality of experience	Y
	Cleaner environment	Y
	More recreational facilities/activities	Y
	Attractiveness of surroundings	Y
	Increased choice (hotels, retail etc)	N
	Unique sense of place	Y
	Cruise liner terminal	Y
	Reduced crime	?
Local authorities	Partnership and collective action	N
	Increased influence	N
	Cleaner air and water	Y
	Reduced flood risk	Y
	Increased economic activity	?
	Carbon savings (and energy)	Y
	Inward investment	N
	Reduction in derelict land	?
	Reduced cost of pollutants/ contaminants	Y
	Strengthened brand	Y

Figure 8: Mapping the environmental benefits/stakeholders in the River Mersey Task Force Study (right hand columns), against a typical ES framework (left hand column).

Ecosystem good/services	
Landowners	Crops
	Livestock
	Capture Fisheries
	Aquaculture
	Wild foods
	Timber/other woods
	Fibres/resins
	Animal Skins
	Sand
	Ornamental resources
	Biomass
	Freshwater
	Generic resources
	Biochemical
Regulating	Air quality
	Global climate reg.
	Regional/local climate reg.
	Reg. of water timing/flows
	Erosion control
	Water purification/waste treatment
	Disease mitigation
	Maintenance of soil quality
	Pest mitigation
	Pollination
	Natural hazard mitig.
Cultural	Recreation and ecotourism
	Ethical and spiritual values
	Educational and inspirational values
	Other

Environmental benefits	
Increased resilience	Businesses
Improved workplace	
Global connectivity	
Increased property/land value	
Improved saleability	
Reduced vulnerability to climate change	
Increased land value	Developers and investors
Increased property value	
Wind and tidal power	
Improved quality of place	Residents
Cleaner environment	
Reduced flood risk	
Increased biodiversity	
Carbon savings	
More recreational facilities	
Resilience	
Quality of life	
Education - raising skills	
Research opportunities	Academic Establishments
Global connectivity	
Water innovation	
Increased quality of experience	Tourists and visitors
Cleaner environment	
More recreational facilities/activities	
Attractiveness of surroundings	
Unique sense of place	
Cruise liner terminal	
Cleaner air	Local authorities
Cleaner water	
Reduced flood risk	
Carbon savings (and energy)	
Reduced cost of pollutants/ contaminants	
Strengthened brand	

Relocate to other stakeholders

The mapping exercises (Figure 7) demonstrated that firstly, there are a number of benefits which could not be linked to the Mersey as an environmental asset. These benefits (i.e. those marked "N" or "?" in Figure 7) may be extremely important, but cannot be considered within the bounds of this study, as the focus of the research is socio-economic benefits associated with the environment.

The results of the mapping exercise in Figure 8 above indicate the following:

- Whilst the benefits listed are numerous, the final ecosystem services (when considered against a typical ES framework), are less extensive.
- A large number of benefits are identified as "other", which suggests any valuation exercise looking at the Mersey, should be flexible in its approach, and not stick rigidly to a particular framework.
- A number of the benefits identified by the River Mersey Task Force, whilst relevant, do not take the additional step of identifying a "Final" good or service. For example "increased biodiversity", whilst having an intrinsic value (Section 3.2), is not a final good or service. Examples of a final services might be recreation from bird watching or agricultural pollination, the values of which are significant (these are added into the analysis in later sections).
- Certain benefits which are shown to accrue to local authorities, should be reallocated to other sections of society or to other communities. Similar to this, "carbon savings", which is shown as a benefit to "residents", should be seen as a benefit to wider (or "global") society.
- Some benefits identified in the River Mersey Task Force report, whilst very significant to certain individuals or business, are not considered to be best practice in most ecosystem service models; specifically, these relate to increased values of assets such as houses and land.
- There is no consideration of provisioning services, while some regulating services have not yet been considered.

Appendix A and B contain targeted research relating to specific environmental and socio-economic themes. The findings have been used to illustrate the concepts set out in this section. Section 4 uses the River Mersey Task Force data and analysis and transposes it into the Total Economic Value framework.

4 VALUE: QUALITATIVE ANALYSIS

4.1 Introduction

This section takes the baseline research shown in Appendix A and B, and presents it using Total Economic Value (TEV) and ecosystem services frameworks. The purpose of this is to describe to contribution to social and economic welfare (in an economic sense, where welfare describes well-being).

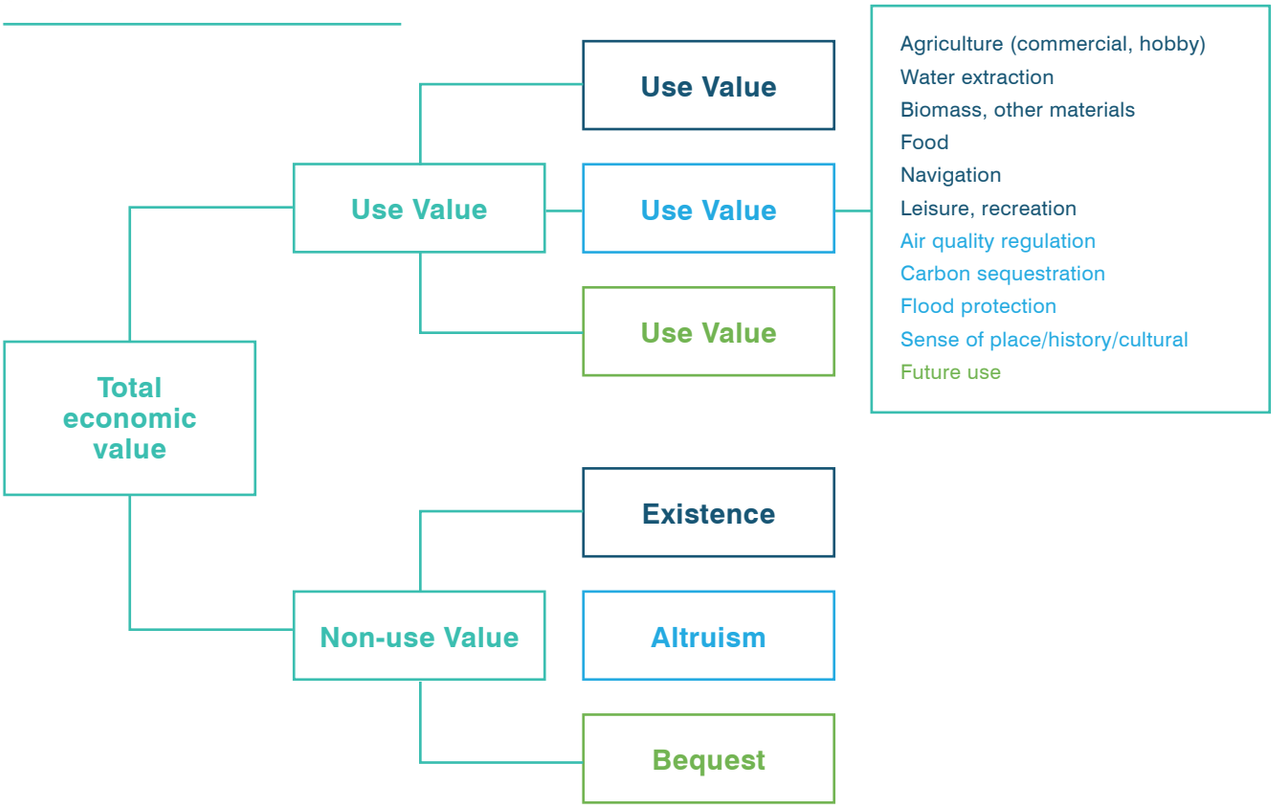
The River Mersey is a significant presence across the LCR, both environmentally and economically. The purpose of the TEV exercise is to draw out those ecosystem services which are material to the sustainable development and management of the LCR.

Following presentation of the TEV framework, a baseline Ecosystem Services framework is developed to understand final services. This is an illustrative representation of the ecosystem service provided. It should be seen as a starting point, for use in assessing the impact of changes from future projects or investments, including trade-offs.

4.2 The TEV framework

Using the findings of the research outlined in the previous section, a qualitative appraisal has taken place to describe the value of the River Mersey using the TEV framework, (Figure 9). The purpose of this exercise, and subsequent ecosystem services assessment, is to isolate the site benefits so that they can be examined individually, understood and aggregated for future assessments.

Figure 9: Total Economic Value (TEV) framework.



Use-values relate to the social and economic benefits obtained from direct use of site. These may include direct consumption of extracted resources (e.g. food and raw materials), direct utilisation of a site (e.g. recreation) and/ or indirect use through local air quality regulation or erosion prevention - services with social and economic consequences/ benefits, provided by the asset but with no market value (Table 1).

Table 1: Total Economic Value, explained by component parts.

Value	Ecosystem Services	Stakeholders
Direct use	Agriculture	• The agricultural sector across the LCR • Employees and their families
	Water extraction	• Specialist businesses in the LCR • Employees and their families
	Biomass, other materials	• Various businesses in the LCR • Employees and their families
	Food	• Food businesses in the LCR • Employees • Consumers
	Navigation	• Various businesses in the LCR
	Leisure, recreation	• Visitors • Residents of the LCR • Employees
Indirect use	Air quality regulation	• Residents of the LCR • Health service / rest of the UK
	Carbon Sequestration	• “Global” Society
	Flood protection	• Residents near to river
	Sense of place historical/ cultural connection	• Visitors • Residents of the LCR
Option	Future use	Various (This could be across direct and indirect values identified above)
Existence	Accrues to those who know about the Mersey, but do not “use” the river in any way. Beneficiaries could be drawn from a wide range of the local and wider population (including international). They would suffer a disbenefit if the Mersey ceased to exist. **Existence value may relate to:** • A historic connection to the Mersey, for example someone who grew up near the Mersey, but no longer lives nearby. There is a connection, but current or intended future use. • A general interest in the river. For example, this could be a rivers enthusiast, who has no intension to visit (i.e. “directly use”) the Mersey.	
Altruism	Accrues to those who gain value from knowing others benefit from the site. Value may be attached to the fact that other people of the present generation have access to the benefits provided by the Mersey.	
Bequest	Value from knowing future generations will benefit from the Mersey’s unique goods/services it provides.	

4.3 Identifying stakeholders

The analysis has identified a number of key stakeholders for further investigation. Focussing initially on the direct and indirect users, the list has been condensed to nine key stakeholders:

1. Agricultural/food business.
2. Water dependent business.
3. Business dependent on navigation.
4. Employees across all sectors linked to environment.
5. Visitors from outside LCR.
6. Residents of the LCR.
7. Residents near to river.
8. Rest of the UK.
9. Global society.

4.4 Applying an ecosystem service framework

The concept of ecosystem services was introduced in Section 3 of this report. Considering these services is a further step in categorising the benefits of the River Mersey as a Natural Capital asset. The following are considered

- **Provisioning services:** Stakeholders (businesses, individuals, communities) gain value from the environment's direct provision of goods and services. They gain utility (satisfaction) from consumption of these goods which are provided freely by the environment or in combination with other forms of capital (human, financial, economic).
- **Regulating services:** Stakeholders gain value from the environment's indirect provision environmental services. They gain utility from the services the environment provides for free. These predominantly relate to protection from environmental forces (flooding, other extreme weather), regulation of the environmental status quo or removal of pollutants.
- **Cultural services:** Stakeholders gain value from the environment's ability to create unique places for recreation and other experiences. Value is also attained through the spiritual connection with the environment. These are often less tangible than provisioning and regulating services.
- **Other:** Benefits which are linked to the environmental asset, i.e. are linked to the Mersey as a natural capital asset, but may be beyond the chosen ES framework.

Assessment frameworks based on TEEB, the UKNEA of Corporate Ecosystem Value[7] are useful for assessing the above. For the below appraisal, the CEV pre-defined ES framework has been used. This framework is shown in Figure 10.

[7] http://www.wbcsd.org/work-program/ecosystems/cev.aspx

Figure 10: the ecosystem service framework displays the value (defined as a series of environmental goods and services) from the River Mersey, to a defined set of stakeholders.

No.	Provisioning services	Crops	Livestock	Capture Fisheries	Aqua-culture	Wild foods	Timber/other wood
1	Agricultural/food business	+	+	+	+	0	0
2	Water dependent business	0	0	0	0	0	0
3	Business dependent on navigation	0	0	0	0	0	0
4	Employees in jobs linked to river	0	0	0	0	0	0
5	Visitors	0	0	0	0	0	0
6	Residents near the river	0	0	0	0	+	0
7	Residents of the LCR	0	0	0	0	+	0
8	Rest of the UK	0	0	0	0	0	0
9	Global society	0	0	0	0	0	0

No.	Provisioning services	Air quality	Global climate change reg.	Regional/ local climate reg.	Reg. of water timing/flows	Erosion control
1	Agricultural/food business	0	0	0	+	0
2	Water dependent business	0	0	+	+	0
3	Business dependent on navigation	0	0	0	0	0
4	Employees in jobs linked to river	0	0	0	0	0
5	Visitors	0	0	0	0	0
6	Residents near the river	+	0	+	+	0
7	Residents of the LCR	+	0	+	0	0
8	Rest of the UK	0	0	0	0	0
9	Global society	0	+	0	0	0

No.	Provisioning services	Recreation and ecotourism	Ethical and spiritual values	Educational and inspirational values
1	Agricultural/food business	0	0	0
2	Water dependent business	0	0	0
3	Business dependent on navigation	0	0	0
4	Employees in jobs linked to river	0	0	0
5	Visitors	+	0	0
6	Residents near the river	+	+	+
7	Residents of the LCR	+	+	+
8	Rest of the UK	0	0	0
9	Global society	0	0	0

	Fibres/ resins	Animal skins	Sand	Ornamental resources	Biomass	Freshwater	Genetic res.	Biochem etc.
	0	0	0	0	+	0	0	0
	0	0	0	0	0	+	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0

	Water purif./ waste treatment	Disease mitigation	Maint. of soil quality	Pest mitigation	Pollination	Natural hazard mitig.
	+	0	+	+	+	0
	+	0	0	0	0	+
		0	0	0	0	0
		0	0	0	0	0
		0	0	0	0	0
		0	0	0	0	0
		0	0	0	0	0
		0	0	0	0	0
		0	0	0	0	0

No.	Provisioning services	Navigation	Reduced health expend	Employment, a livelihood	Unemployment costs
1	Agricultural/food business	0	0	0	0
2	Water dependent business	0	0	0	0
3	Business dependent on navigation	+	0	0	0
4	Employees in jobs linked to river	0	0	+	0
5	Visitors	0	0	0	0
6	Residents near the river	0	0	0	0
7	Residents of the LCR	0	0	0	0
8	Rest of the UK	0	+	0	+
9	Global society	0	0	0	0

Agricultural/food business

Crops	Livestock	Capture Fisheries	Aquaculture	
Reg. of water timing/flows	Water purif. / waste treatment	Maint. of soil quality	Pest mitigation	Pollination

These businesses / sector are inherently linked to the River Mersey. They obtain naturally occurring products and through their own endeavour, generate value. They also receive economic benefits from the environment through a series of regulating services, which ensure land is protected from natural hazards and pests, but its ability to assimilate pollutants.

Over half (58%) of Merseyside is designated as 'rural' (Figure 2, Section 2), with 600 farms operating in the area (Figure 24). This study is concerned with the agricultural benefits linked to the River Mersey. The majority of the land adjacent to the river corridor is classed as urban. However, a small part is Grade 1-5 agricultural land. Using mapping (source: http://www.magic.gov.uk/) it was estimated there was approximately 510 hectares grade 1-3 agricultural land along the River Mersey.

In addition, the River Mersey also provided edible bivalve molluscs (Section 4.6). The area of the protection zone, shown in Appendix A is 870 hectares.

Figure 11: Agricultural land adjacent to the Mersey.

[7] http://www.wbcsd.org/work-program/ecosystems/cev.aspx

Water dependent business

Freshwater			
Regional/local climate reg.	Reg. of water timing/flows	Water purif. / waste treatment	Natural hazard mitig.

This group of stakeholders depend on the water of the river, either for supply or its ability to remove/dilute pollutants (this includes the ability to take large quantities of water for disposal).

Liverpool Wastewater Treatment Works is located at Wellington Dock. It is operated by United Utilities, the UK's largest water company. Effluent is delivered to the works, and clean water is disposed of into the river. This ability to take large quantities of water from the treatment works is a free service which the facility is dependent on.

Surface water abstraction within the Lower Mersey area is heavily dominated by industrial abstraction and to a lesser extent, agriculture. There are no surface water abstractions for public water supply primarily due to water quality issues. In contrast, the main abstraction from groundwater is for public water supply (source: Environment Agency[8]).

Data showing water abstraction rates from the Environment Agency for the North West is shown in Table 2. No data could be found at the time of writing for the Lower Mersey Catchment. There are 12 catchments across the North West (Figure 12), dividing the totals by 12 (shown in brackets in the table) gives a crude indication of quantities abstracted per catchment[9].

Table 2: Surface water extraction across the North West in 2013(Source: ONS / Environment Agency[10]).

Use	Quantity (m3 million) (one twelfth shown in parenthesis)
Public water supply	505 (42)
Spray irrigation	2 (0.2)
Agriculture (excl. spray irrigation)	2 (0.2)
Electricity supply industry	550 (46)
Other industry	196 (16)
Fish farming, cress growing, amenity ponds	13 (1)
Private water supply	0 (0)
Other	2 (0.2)
Total	**1,271 (106)**

Figure 12: the catchments of the North West

[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/300490/LIT_7881_35d3ed.pdf

[9] It is acknowledged that this is a crude measurement given the different socio-economic and environmental settings of each catchment, but given the constraints of the study, this was deemed an appropriate starting point.

[10] https://www.gov.uk/government/statistical-data-sets/env15-water-abstraction-tables

Business dependent on navigation

Navigation

Businesses which depend on navigating the Mersey include businesses situated on the docks, and those in-land which are dependent on materials brought into the LCR via the docks. They generate value through the combination of natural, human and economic capital.

The Port of Liverpool is a 12 dock system that runs from Brunswick Dock in Liverpool to Seaforth Dock: Seaforth, on the east side of the River Mersey and the Birkenhead Docks between Birkenhead and Wallasey on the west side of the river. It is the most important UK deep sea container port for container services between Great Britain and North America and is ranked 7th in the UK in terms of total tonnage, with 30 million tonnes per annum, and 4th largest for container traffic and is the main link to Ireland, with the RORO (Roll-on/ roll-off) terminal handling over 30% of all freight to-and-from Great Britain (source LCR LEP[11]) (Figure 25).

Figure 13: Businesses on the docks generate value, through a combination of their own inputs/investment (capital), knowledge (human capital) and ability to navigate the Mersey. They could not operate without the navigational service offered by the Mersey.

Liverpool Marina is located just outside the city centre and is a leisure boat mooring site, with 350 permanent berths, and various other leisure facilities.

Port of Garston (not part of Port of Liverpool), on the north bank of the River Mersey, is seven miles from Liverpool city centre. Run by the association of British Ports, it handles dry bulks, general cargo, scrap metal and steel. Key statistics are set out below[12].

[11] https://www.liverpoollep.org/wp-content/uploads/2015/06/LCR-superport-market-analysis-03.2014.pdf

[12] http://www.abports.co.uk/Our_Locations/Short_Sea_Ports/Garston/

Table 3: Port of Garston Statistics

Use		Normal acceptance dimension of vessels			
Dock, Jetty or Quay	Quay length	Length	Beam	Draught	Approx. dwt
Stalbridge Dock	975 m	152.4 m	19.2 m	9.0 m	10,000
Old & North Dock	1,405 m	152.4 m	19.2 m	7.5 m	6,500

Employees across all sectors linked to environment

Employment, a livelihood

Livelihoods and the prosperity of many individuals and households will be dependent on the jobs supported by the river. Appendix A and B outlined a number of industries in close proximity to the Mersey which may be dependent on the River Mersey. The absolute figures are shown below in Table 4. This likely to be an over-estimate, but starting point for the purpose of this analysis.

Table 4: numbers of employees by industry groups along the Mersey Corridor and across the LCR

Industry grouping	Mersey Corridor	LCR
Agriculture, forestry and fishing	108	1,234
Manufacturing: Food, beverages and tobacco	1,372	8,488
Manufacturing: Textiles, wearing apparel and leather and related products	206	1,537
Manufacturing: Wood, paper and paper products	252	1,605
Electricity, gas, steam and air conditioning supply	443	2,793
Water supply, sewerage, waste management and remediation activities	941	5,756
Arts, entertainment and recreation; other service activities	4,998	31,462
Total	**8,320**	**52,875**

Visitors from outside LCR

Recreation and ecotourism

The LCR has a strong visitor economy (see Appendix B). A proportion of all visits will be linked to attractions which are linked to the river, either in part, or entirely. Figure 14 sets out "drivers of significant new leisure visitors to Liverpool City Region". Of these, Port Sunlight (which includes a river side park) is the one with clearest links to the river itself.

Figure 14: Liverpool City Region Local Enterprise Partnership (LEP) identifies a number of leisure attractions which drive visitors to the LCR, many of these are inherently linked to the river (source: https://www.liverpoollep.org/wp-content/uploads/2015/06/wpid-vistor-economyfullstrategy-03-2011.pdf).

Drivers of Significant[20] new leisure visitors to Liverpool City region				
	International	**UK overnight**	**Regional day**	**Local day**
Liverpool	Yes	Yes	Yes	Yes
Southport	No	Yes	Yes	Yes
England's Golf coast	Yes	Yes	Yes	Yes
Port Sunlight and West Kirby	No	Yes	Yes	Yes
Wirral and Sefton coast	No	Potentially	Yes	Yes
New Brighton, Crosby, George Street, St Helens	No	Potentially	Yes	Yes
Selected attractions and events	A small number of Beatles, sport and cultural events and attractions	A small number of sport and cultural attractions	Yes	Yes
Other attractions and events	No	No	Yes	Yes

The above highlights the significant attractions across the LCR which draw in visitors from different areas. There are large amount of other smaller recreational users along the Mersey which will draw visitors from outside the LCR.

Figure 15: Liverpool City Region Local Enterprise Partnership (LEP) identifies a number of statistics for visitors to the LCR (source: https://www.liverpoollep.org/wp-content/uploads/2015/06/wpid-vistor-economyfullstrategy-03-2011.pdf)

	2006	2007	2008	2009	2010	2011	2012	2013
Core Measures								
No. of staying nights (m) City Region	**10.7**	**11.0**	**11.3**	**10.6**	10.8	11.1	11.4	11.8
No. of staying nights (m) Liverpool	**3.7**	**3.8**	**4.4**	**4.1**	4.2	4.3	4.4	4.6
No. of overseas visitors nights (m)	**4.5**	**3.9**	**4.7**	**4.3**	4.4	4.6	4.8	5.2
Total staying tourism spend (m)	**£767**	**£801**	**£854**	**£814**	£827	£841	£855	£913
Tourism related employment*	**36,700**	**38,600**	**46,300**	**40,600**	41,300	42,000	42,600	45,500
Average spend per staying night	**£71.68**	**£72.82**	**£75.58**	**£76.80**	£76.45	£75.89	£75.21	£77.05
Index of attractions (indexed to 2004)	**99**	**116**	**155**	**124**	132	134	138	142
Room occupancy - Liverpool	**73%**	**71%**	**76%**	**69%**	**70%**	71%	72%	72%
Bed spaces**	**27,000**	**28,000**	**31,000**	**33,000**	**34,000**	35,000	36,000	38,000
Additional indicators								
No. of day visits (m)	**43.3**	**44.4**	**55.4**	**48.2**	51.3	52.1	53.6	55.1
Total day visit spend (m)	**£1,747**	**£1,781**	**£2,273**	**£1,943**	£2,212	£2,244	£2,310	£2,398
Nights spent in serviced accommodation (m)	**3.4**	**3.6**	**3.9**	**3.4**	3.5	3.6	3.8	4.1
Total room nights sold in Liverpool (000)	**694**	**725**	**910**	**897**	**1,045**	1,086	1,131	1,208
Performance measures								
Passenger traffic via LJL Airport (m)	**5.0**	**5.5**	**5.4**	**4.9**	**5.0**	5.4	5.7	6.1

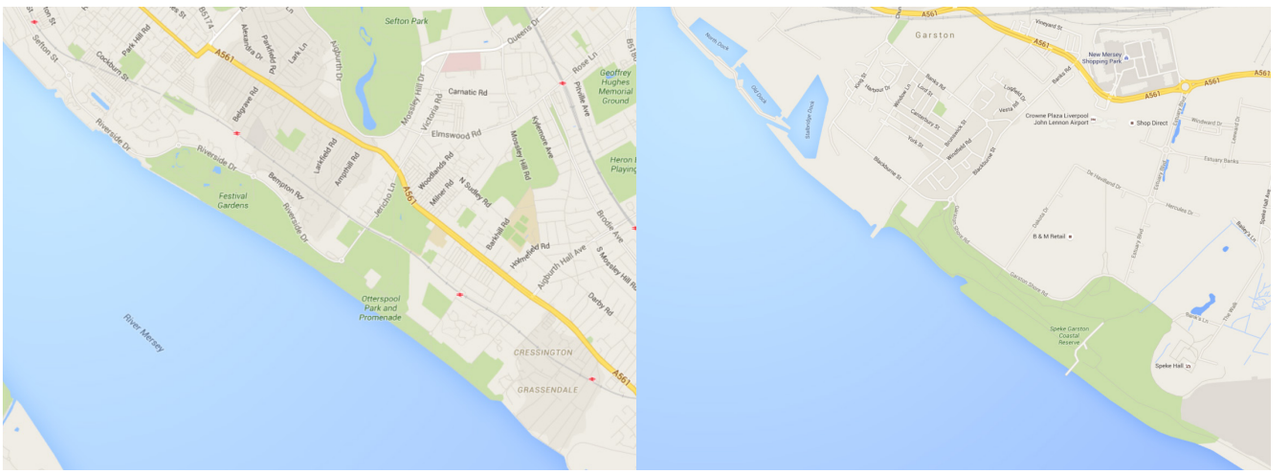
	2006	2014	2015	2016	2017	2018	2019	2020
Core Measures								
No. of staying nights (m) City Region	**10.7**	12.1	12.2	12.7	12.9	13.2	13.5	13.5
No. of staying nights (m) Liverpool	**3.7**	4.7	4.7	4.9	5.0	5.1	5.2	5.2
No. of overseas visitors nights (m)	**4.5**	5.3	5.5	5.8	6.0	6.2	6.4	6.4
Total staying tourism spend (m)	**£767**	£938	£960	£1,017	£1,039	£1,076	£1,113	£1,113
Tourism related employment*	**36,700**	46,700	47,900	50,700	51,800	53,600	55,500	55,500
Average spend per staying night	**£71.68**	£77.79	£78.41	£79.97	£80.55	£81.45	£82.33	£82.33
Index of attractions (indexed to 2004)	**99**	147	150	155	159	164	169	173
Room occupancy - Liverpool	**73%**	73%	73%	74%	74%	75%	76%	76%
Bed spaces**	**27,000**	39,000	39,000	41,000	42,000	43,000	44,000	44,000
Additional indicators								
No. of day visits (m)	**43.3**	57.0	58.5	60.4	61.9	63.8	65.6	67.2
Total day visit spend (m)	**£1.747**	£2,505	£2,597	£2,708	£2,803	£3,918	£3,034	£3,135

Benefits to the Liverpool City Region

Wild foods		
Air quality	Regional/local climate reg.	
Recreation and ecotourism	Ethical and spiritual values	Educational and inspirational values

The total population of the LCR is approximately 1.5 million people. Residents, particularly those who have lived for a long time, near to the river, will have a cultural connection to it, and may occasionally use the environment for recreational activities (e.g. to sites such as those shown in Figure 16).

Figure 16: smaller scale recreational sites on the River Mersey (Festival Gardens and Otterspool Park and Promenade, left and Speke Garston Coastal Reserve, right)



Benefits to residents living adjacent to the River Mersey

Wild foods		
Air quality	Regional/local climate reg.	Reg. of water timing/flows
Recreation and ecotourism	Ethical and spiritual values	Educational and inspirational values

This group of stakeholders will receive a number of benefits form the river. They will have more frequent interactions with the river than with wider LCR population (for example through views or recreational use), and may be more dependent on the regulating services it provides (e.g. flood event regulation). Using the Mersey Corridor area defined previously, it is estimated that 230,000 residents of the LCR live near to the river.

Wider benefits to the UK from the River Mersey

Reduced health expend	No unemployment costs

The rest of the UK benefits from avoided health spending associated with certain services provided by the Mersey and the surrounding environments. This can relate to its ability to assimilate air pollutants and the associated avoided health costs. Equally, there is an avoided cost associated with the jobs supported by the river.

Global benefits from the River Mersey

Global climate reg.

The global society benefits from the carbon sequestered by the Mersey and its surrounding environments. Different environments associated with the river will sequester carbon at different rates.

4.5 Summary

What has been shown in this section, is a qualitative appraisal of ecosystem services from the Mersey for a defined set of stakeholders. This is a snapshot based on desk based research. It is not intended to be exhaustive, rather, its primary use may be in starting and structuring debate about relative values between stakeholders. The framework could also be used to understand trade-offs under different future scenarios.

The benefits provided are complex and numerous, and there are clear interdependencies, conflicts and potential trade-offs. The next section seeks to take the analysis a step further and add some qualitative analysis based on the above.

What has been shown in this section, is a qualitative appraisal of ecosystem services from the Mersey for a defined set of stakeholders.

5 VALUE: QUANTITATIVE ANALYSIS

5.1 Introduction

The previous sections summarise the qualitative nature of the Mersey's value, in its socio-economic and environmental context. The different categories of value have been identified through the use of TEV and ecosystem service frameworks resulting in a defined set of services and stakeholders. As set out previously, this is not intended to be definitive - it represents the result of this desk-based study, and is intended for use in framing and encouraging debate.

This section extends the analysis by first quantifying the stakeholders which have been identified, and secondly, attaching monetary values to specific services, based on other research (cited throughout).

5.2 Per annum estimates

Agricultural/food business

In 2012, the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) estimated total of 705 jobs in the shellfish sector[13], throughout the UK, and 3,300 hectares in production or cultivation[14]. On a pro-rata basis it can be inferred that the Mersey supports 0.2 jobs per hectare, on an area of 870 hectares, providing an estimated 174 full time jobs. In the same year, the value of UK's total shellfish harvest was £33.2m (from 27360 tonnes), or approximately £47,000 per employee. This suggests an approximate value of £8.1m of value from the Mersey's shellfish production.

As estimated in Appendix B, agriculture, forestry and fishing accounts for approximately 1,234 jobs across the LCR. It has not been possible to disaggregate these figures, to analyse the number of jobs in agriculture alone. Data on the North West's agricultural sector[15] indicates, however, that in 2008 agriculture contributed £515 million of Gross Value Added (GVA) to the North West's economy, from around 909,000 hectares[16]. This equates to approximately £570 of GVA per hectare. It was estimated that 510 hectares of agricultural land exists along the Mersey corridor, therefore an approximate value of £288,944 of GVA per annum. This contribution of the river to the agricultural sector is expected to be much larger at the catchment level.

Water dependent business

Based on rough approximations in Table 2 (Section 4.4), the Mersey catchment supplies the following surface water extraction services:

- 505 million m^3 for public water supply
- 550 million m^3 for electricity industry
- 196 million m^3 for other industry.

This totals 1,251 (million) m^3 of water supplied by the River Mersey (estimated). The Environment Agency charges £12.57 for every 1,000m3 of water abstracted in the North West[17] , suggesting the value of all surface water abstracted in the Lower Mersey Catchment is £157,250,700.

In 2012, the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) estimated total of 705 jobs in the shellfish sector, throughout the UK, and 3,300 hectares in production or cultivation.

[13] Source: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/405469/Aquaculture_Statistics_UK_2012.pdf

[14] https://www.cefas.co.uk/publications/techrep/techrep136.pdf

[15] Data taken from Farm Business Survey: http://www.farmbusinesssurvey.co.uk/regional/commentary/2010/northwest.pdf

[16] http://www3.lancashire.gov.uk/corporate/web/viewdoc.asp?id=122501

[17] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/466353/LIT_9909.pdf

Business dependent on navigation

As shown in previous sections, Liverpool City Region has an extensive array of ports and coastal infrastructure. Based on data summarised in Figure 33 below, in 2007 it was estimated that 536 jobs were in sea and coastal water transport and 208 were employed in inland water transport. In addition, many more jobs were in associated sectors (e.g. storage and handling), however the dependency of these on coastal infrastructure could not be ascertained during this desk-based study.

Figure 17: employment across transport related sectors (source: MDS Transmodal[18])

	Halton		Knowsley		Liverpool		Sefton		St Helens		Wirral		Merseyside	
SIC Code (2003)	**No**	**LQ**	**No**	**LQ**	**No**	**LQ**	**No**	**LQ**	**No**	**LQ**	**No**	**LQ**	**No**	**LQ**
6024: Freight transport by road	2,738	5.0	1,118	2.0	617	0.3	486	0.5	3,050	4.8	299	0.3	8,308	1.4
6110: Sea and coastal water transport	5	0.2	2	0.1	226	1.8	33	0.6	2	0.1	0	0.0	268	0.8
6120: Inland water transport	7	2.3	0	0.0	3	0.2	1	0.2	0	0.0	93	17.0	104	3.1
6210: Scheduled air transport	0	0.0	0	0.0	486	0.8	0	0.0	0	0.0	1	0.0	487	0.3
6220: Non-scheduled air transport	1	0.0	0	0.0	128	0.8	0	0.0	0	0.0	1	0.0	130	0.3
6311: Cargo handling	19	1.2	7	0.4	54	0.8	12	0.4	0	0.0	3	0.1	95	0.5
6312: Storage and warehousing	433	1.6	407	1.4	477	0.4	219	0.5	1,736	5.4	309	0.6	3,581	1.2
6321: Other supporting land transport activities	23	0.2	4	0.0	2,095	3.3	36	0.1	149	0.9	144	0.5	2,451	1.5
6340: Activities of other transport agencies	55	0.4	116	0.9	1,317	2.6	230	1.1	147	1.0	97	0.4	1,962	1.5
6720: Activities auxiliary to insurance and pension funding	230	0.8	112	0.4	1,426	1.2	470	0.9	63	0.2	263	0.5	2,564	0.8
Total Transport	3,511	2.2	1,766	1.1	6,829	1.0	1,487	0.5	5,147	2.8	1,210	0.4	19,950	1.1

Using an average GVA per worker in the Liverpool City Region of £45,000, this puts the economic contribution of employment in river transport/navigation at £33,480,000 per annum.

[18] http://www.knowsley.gov.uk/pdf/lc07_liverpoolsuperporteconomictrendsstudy.pdf

[19] Approximate value from the Centre for Cites; http://www.centreforcities.org/wp-content/uploads/2015/06/15-06-01-Northern-Powerhouse-Factsheet.pdf

Employees across all sectors linked to environment

The value of being in employment is different to the value an employee provides for a company or an economy. There is security associated with being in employment, and people in work have the freedom to make choices they may be denied by unemployment. This factor is outside the scope of this study, but could be an area for future research.

Future studies may also consider the marginal impact of interventions which take people out of unemployment. This has a clear cost saving to the UK government, but equally provides wellbeing benefits to the individual in employment (as a guide, research indicates this wellbeing value may be in the region of £11,000[20] per person in employment per year).

Recreation (i.e. visitors from outside LCR; residents of the LCR and residents near the river)

The visitor economy in the LCR is strong, however, it has not been possible to ascertain a detailed estimate of recreation activities associated with the River Mersey. It has also not been possible to derive a figure for residents within the LCR who frequently make use of the river, or its surrounding environments for recreational use. Such data (or reasonable assumptions) will be required to provide an aggregate total value for recreational use.

Table 5: Values for specific types of recreational use (various sources)

Recreation type	Area		Value	Unit	Year
Recreation: Day visitors	RSPB statistics	South Stack	£13.61	£/person/trip	Unknown
		Frampton Marsh	£6.40	£/person/trip	Unknown
		Arne	£9.73	£/person/trip	Unknown
Recreation: Holiday Makers	RSPB statistics	South Stack	£121.32	£/person/trip	Unknown
		Frampton Marsh	£108.50	£/person/trip	Unknown
		Arne	£133.00	£/person/trip	Unknown
Casual walking	Unknown		£5.59	£ per visit	2007
Freshwater angling	In/around Leeds		£2.21	£ per visit	2001
Tourist - day	North West (STEAM model)		£19.79	Average spend in the NW, day	2006
Tourist - night			£72.40	Average spend in the NW, day	2006

Table 5 shows the range of values from various studies for recreational use, however, without reasonable assumptions relating to visitor characteristics, it is difficult to aggregate these. For example, if it could be said, that 5% of LCR residents make use of the River Mersey or the surrounding areas for recreational use, this would equate to 75,000 people visitors, depending on what these visitors did, the recreational value could be £165,750 per annum to £9,975,000 (using the lowest and highest values in Table 5).

[20] http://www.globalvaluexchange.org/valuations/8279e41d9e5e0bd8499f31cb

Air quality and health

Various characteristics of the Mersey corridor have the potential to remove airborne pollutants form the air. This has obvious health benefits, where the final quantifiable cost saving, comes in the form of avoided costs to the UK National Health Service (or the UK tax payer).

Forestry Commission research states "one hectare of mixed forest can remove 15t of particulates per year from the air while a pure spruce forest may filter two or three times as much (cited in Bolund, 1999)."[21] The UK government quantifies a damage cost per tonne of particulates of £45,510 £/tonne (low estimate)[22]. Using this to estimate the potential benefits of the 219 hectares of woodland identified along the river corridor, provides an approximate figure of £149,500,350 per annum. Other habitats which have not been considered here may offer further benefits.

Not considered here, but potentially very significant, are the mental health benefits from the natural environment. This would also be linked to the recreational use of the River. This is particular important given the high levels of deprivation in parts of the LCR and along the river, and its impacts on worklessness and the economy. Connection with Nature and physical wellbeing is also important.

Global Society

Using the site areas defined in Appendix A of this report, and sequestration rates for different land-types, it is possible to estimate the amount of carbon sequestered by the River Mersey corridor per annum. Applying the non-traded price of carbon (2015) £61.79[23] £/tCO2e, a total value of around £230,000 per annum was estimated (see Table 6). This is expected to be much higher, when considering influence of the river is considered at the catchment level.

Table 6: Carbon sequestration rates

Land typology	Area (hectares)	Sequestration rate (T/CO2e/ha/year)	Non-traded price of carbon (2015) (£ / T / CO2e)	Value per hectare per annum	Total value per annum
English Woodland Grant Schemes	172	5.2	61.79	321	
Woodland Trust Sites	47	5.2		32	
Coastal saltmarsh	879	2.23		138	
Maritime cliff and slope	8	no data available		no data available	
Mudflats	3605	0.16		10	35,640
Coastal and floodplain grazing marsh	18	no data available		no data available	
Deciduous woodland	53	captured above		no data available	
Good quality semi improved grassland	9	2.2		136	1,223
Reedbeds	1	no data available		no data available	
				Total	£228,349

[21] http://www.forestry.gov.uk/pdf/urgp_evidence_note_006_Improving_air_quality.pdf/$FILE/urgp_evidence_note_006_Improving_air_quality.pdf

[22] Air quality damage costs per tonne, 2015 prices: https://www.gov.uk/guidance/air-quality-economic-analysis

[23] From: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/360316/20141001_2014_DECC_HMT_Supplementary_Appraisal_Guidance.pdf

6 CONCLUSIONS AND DISCUSSION

6.1 The evaluation

The premise of this research has been the following: The River Mersey contributes economic and social value to the Liverpool City Region, what is the nature of that value, and can it be quantified? In many cases there would be no value created without the natural capital asset, but equally, no end value could be realised without human creativity, investment or time. This is true across a range of areas, from improved health to the national economic contributions from the port.

The figures included in the evaluation are intended as a first step in describing the value created. Further study should seek to review, reject and/or refine these approximations to seek further understanding. This should include rigorous assessment of the data sources, and appropriate adjustments to account for the following factors:

- Attribution and leakage – what is the proportion of final benefit is attributable to the river, how much is attributable to other inputs, how much of the final benefit "leaks" out of the study area.
- Confidence in the data source – data needs to be thoroughly appraised in terms of reliability, and suitable adjustments made.
- Inflation – the data need to be adjusted to account for inflation.
- Socio-economic adjustments – where data has been transferred from one study are to another, this will need to be adjusted to reflect the socio-economic conditions in the LCR.

If it is considered appropriate to carry out more detailed analysis, there may need to be targeted primary data gathering designed and carried out by specialist organisations.

6.2 Devolution and maximising value

The recent devolution agreement[24] for the Liverpool City Region rightly states that the River Mersey is a great asset for tourism and trade. This has not always been the case, and getting to this point has been a long road, with the River Mersey undergoing one of the greatest clean-ups of any river in Europe over the last thirty years. This clean-up has taken significant investment, time and energy, to ensure these efforts are built upon, it is essential that the River Mersey is managed sustainably for all stakeholders.

The devolution agreement states that Liverpool City Region will commit to the cleanest river standard by 2030 and commit to a discharge-free Mersey by 2040. This commitment will help ensure that the socio-economic value potential of the river is achieved.

This research has presented a detailed breakdown of value by certain stakeholders, and from different perspectives, starting with a TEV approach, and building on to an ecosystem services framework. Consideration of value across all the environmental goods and services presented may help in realising optimum (i.e. maximised) value.

Future interventions on the River Mersey could be appraised using the ecosystem service framework, to understand how values for certain stakeholders may increase or decrease. This can help in shaping plans and projects to ensure that the potential of the River Mersey is realised and that overall no stakeholders lose out. This could further be supported by detailed economic (cost-benefit) analysis, should future research allow (see Section 6.1 which describes how numerical findings might be refined).

It is therefore recommended that a total economic value approach is refined for the river, and extended to the catchment scale. This could help guide and inform strategic decisions which affect the LCR and the River Mersey.

6.3 Intrinsic value

As set out in Section 3.2, the river has an intrinsic value, which is not necessarily linked to the socio-economic values discussed throughout this report. Any future studies or interventions which concentrate on value, should have regard for the river's intrinsic value, to ensure economics does not over-ride aspects such as biodiversity (in its own right, not just for human enjoyment) or landscape.

[24] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/477385/Liverpool_devolution_deal_unsigned.pdf

7 RECOMMENDATIONS

7.1 Further study

Further study could be focussed on certain areas where knowledge is low or non-existent (e.g. tourism and the river or deprivation and the river), across everything highlighted in this report, with the intension of providing a more accurate understanding "in numbers".

The geographical scope should be extended to the wider River Mersey Catchment to cover key issues such as carbon sink through land-use e.g. forestry

A multidisciplinary approach is recommended, drawing in expertise from environment, economics, ecology and local experts. Specific research questions might include unpacking how many jobs are connected to or associated with specific environmental services from the river; what is the economic contribution of river-related events and/or what are the health impacts on the river and its environments (and what is the impact on health spending?).

7.2 Governance

If a strategic total economic value view of the River Mersey is to be considered in future decisions, there is a need for strategic governance i.e. a body or individual responsible for considering the total economic value of the river. Such a body or individual should be charged with attempting to represent the viewpoints of all stakeholders who derive value form the river.

The River Mersey Task Force is in a unique position to take on this role, or advise whoever might take on this role. This is furthered by the opportunities under the LCR Devolution Agreement, which present the opportunity to bring the River Mersey Task Force, the LCR Combined Authority and wider stakeholders together as a unified partnership to deliver the River's full potential.

7.3 Traction and investment

The overarching aim of any next steps should be to deliver positive results of the River Mersey, and those who derive value from the goods and services which emanate from it. The value of the river needs to be communicated clearly to gain traction at the highest political level. As such, the case for investment in the river needs to link to the agendas which face the City Region. Specifically these might include:

- Devolution – as outlined in Section 6, the river has a significant role to play in the future of the City Region.
- Inequality and deprivation – the City Region has some of the highest levels of deprivation across most domains, including the living environment domain. The River Mersey can contribute to reducing inequality and deprivation, through improved environmental conditions, and through (direct, indirect and induced) employment.
- Jobs and growth – the high levels of deprivation is associated with above average levels of people in receipt of Job Seekers Allowance (JSA) and other benefits. Particularly impacted upon are young people with above average levels of youth unemployment and also long-term youth unemployment. Investment in the river can effect employment in the same way that it might affect deprivation (e.g. through both environmental improvements, and/or job creation).
- Catchment management – many of the benefits described are commonplace across the whole catchment. As such, this type of thinking ought to be employed across the wider catchment(s) associated with the River Mersey.

7.4 Further consultation

The River Mersey Task Force wishes to enter into dialogue with the LCR Combined Authority to agree the scope and activity needed to implement the devolution agreement. In addition, any further study should include targeted consultation with the identified stakeholders.

Value of Natural Capital from the River Mersey is £348 - £400 million/year across the Liverpool City Region. If extended to the whole catchment we think this value will be well in excess of £1 billion per year.

For further information on this proposal please contact:

Dr Mark Fletcher
Chair of the River Mersey Task Force
Global Water Leader, Arup

t 0113 242 8498
e mark.fletcher@arup.com

Anthony Hatton
Vice Chair of the River Mersey Task Force
Development Director Energy, Peel Energy Ltd

t 0161 629 8388
e ahatton@peel.co.uk

Alan Jemmett
Member of the River Mersey Task Force
Director, Merseyside EAS

t 0151 934 4950
e alan.jemmett@eas.sefton.gov.uk

River Mersey Task Force organisations

ARUP

UNIVERSITY OF LIVERPOOL

Environment Agency

NATURE CONNECTED

and its partner organisations

United Utilities

PEEL

Liverpool City Region Local Enterprise Partnership

ATLANTIC GATEWAY

Merseyside Environmental Advisory Service