

**Appendix 15a:
CWRF background pack for
field workers (Living with
Water)**



KINGSTON UPON HULL

PARTNERSHIP DEVELOPMENT
OF THE GLOBAL CITY WATER
RESILIENCE FRAMEWORK

FIELDWORK - JUNE 2018

THE NEED TO ADDRESS WATER CHALLENGES IS GREATER THAN EVER, BUT SO IS THE OPPORTUNITY TO REDISCOVER THE POSITIVE ROLE OF WATER: ITS POTENTIAL TO SHAPE A SUCCESSFUL, RESILIENT AND SUSTAINABLE CITY.

The Living with Water Partnership

Hull City Council

East Riding of Yorkshire Council

Yorkshire Water

Environment Agency

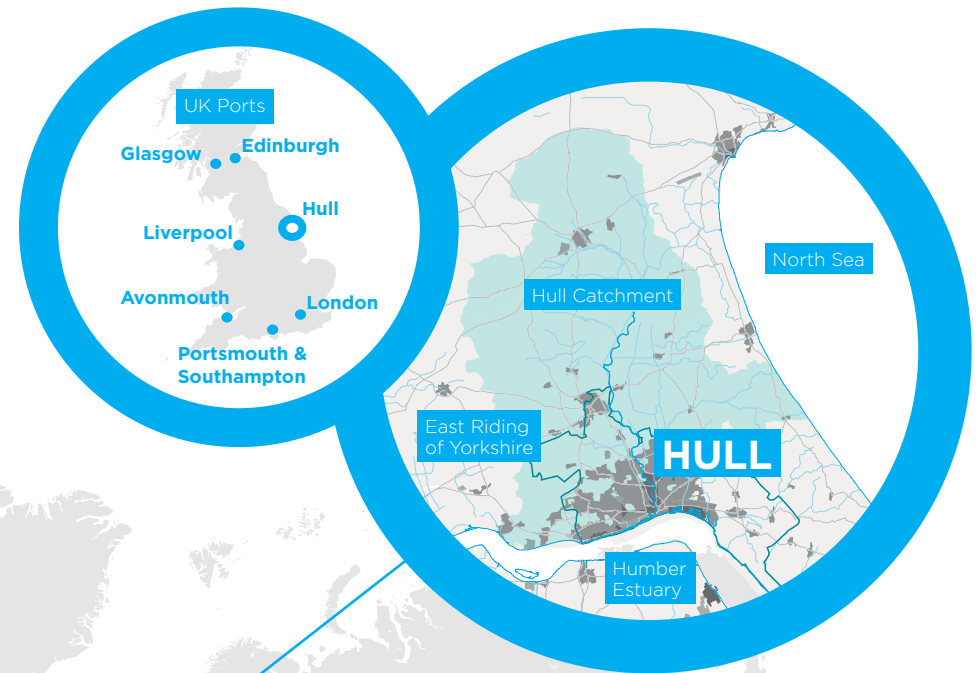


HULL IN CONTEXT

Kingston Upon Hull - normally abbreviated to Hull - is a port city of 260,000 people located on the north bank of the Humber Estuary in the heart of the East Riding of Yorkshire.

Founded on reclaimed tidal marsh, the story of Hull has always been shaped by water, both as an opportunity and as a threat (see Page 4). Now the city faces significant resilience challenges, not least due to its low-lying coastal location, with more homes at risk than any other UK City apart from London. Despite signs of renewal, Hull remains one of the most deprived areas in the UK, with low health outcomes and high unemployment. Communities here are amongst the most vulnerable to climate risks in the UK.

The city's economy grew around farming, whaling, fishing and freight, then chemicals, pharmaceuticals and communications. It prospered to become a major port, which now supports 23,000 jobs. Despite its relatively small population the city plays a key role in the UK economy. The Humber is the largest trading estuary in the UK (by tonnage) and the fourth largest in northern Europe. It is emerging as a world-leading centre for renewables. Hull and the East Riding has recently attracted major investment in offshore wind energy. With a University of 16,000 students and as host for UK City of Culture 2017, the City is building a reputation for innovation, creativity and openness to change. Now Hull is embracing climate adaptation and water-resilience as an opportunity to shape a successful and sustainable future.



Global Knowledge Exchange
 Hull is already twinned with Freetown, Sierra Leone which faces similar water-resilience challenges. Extending this global knowledge exchange to learn from 100RC cities network facing similar challenges will be an important part of working on the CWRf project.

100RC CITIES

- ROUND ONE CITIES
- ROUND TWO CITIES
- ROUND THREE CITIES

Other 100RC partner cities participating in the CWRf pilot phase

£11.6bn
 Economic potential from Humber renewables & ports growth to 2025

14%
 UK International trade handled by Humber ports

90%
 UK NHS medical supplies come from Hull

HULL'S WATER STORY

The way in which water has shaped Hull's cultural identity and economic development has shifted over time depending on available technology and different responses to water-related opportunities and threats. Some of the key events in its history are outlined below.



First port was built by Meaux Abbey monks to export wool

First flood banks and sluices on River Hull

John Smeaton advises on major new land drainage

Ports continue to thrive with new Alexandra Dock and new Hull and Selby Railway

Strengthening of EA flood defences, and constructing the River Hull Tidal Barrier and West & East Hull pumping stations

Partners commence a major flood risk investment programme and collaborate on an Integrated Catchment Model to inform future water-resilience

Tidal marshland is drained for settlement and to create high quality agricultural land

River made navigable to Beverley

Formation of the Dock Company

Poor Laws and investigation of cholera epidemics lead to the 1848 Public Health Act

The University of Hull is founded in 1923

Yorkshire Water construct major new wastewater tunnel and treatment works

The Pitt Review and Coulthard Review of Flooding in Hull recommend transformative change

The Living with Water Partnership and shared vision is established

Hull — 1193 — 1200 — 1800 — 1945 — 2000 — 2017 —

City of Hull given Royal Charter by Edward I

City flourishes through highly productive agriculture, whaling and then, later on, fishing

Hull's William Wilberforce drives through the Slavery Abolition Act

WWII bombings and Abercrombie post-war Reconstruction Plan

Economic decline following Cod Wars and loss of fishing industry

The devastating 2007 floods impact 20,000 people and 91 schools

Hull and the Humber attract major investment in ports and renewable energy

Hull delivers ambitious UK City of Culture programme and legacy plans

Water

Modifying a natural water landscape

Domination and control of the natural world

Supporting intensive urban development

Responding to environmental change

A robust, long-term water strategy

Culture

Water at the heart of every day life

Water increasingly distant from public life

Water 'out of sight, out of mind'

Water as a threat and a catalyst for change

Water at the heart of a new shared vision

**TOWARDS
A WATER
RESILIENT
CITY**

HULL CITY RESILIENCE

The City Resilience Framework developed by the Rockefeller Foundation and used by the 100RC characterises city resilience using four dimensions and 12 goals. The City Water Resilience Framework uses these as a starting point.

The city faces many challenges and opportunities across these dimensions (some of these are indicated opposite). In areas such as unemployment, jobs and skills, wages, mental health and life expectancy, the City is below average, it is one of the most vulnerable to climate risks in the UK.

However, Hull has a long history of bouncing back from challenges, adapting and moving forward. It is already addressing resilience across multiple sectors, from health and housing, to education, employment, water and climate adaptation. Through the LWWP, the groundwork is being laid to align these actions into a comprehensive, catchment-wide resilience strategy.



Left
The City Resilience Framework, developed by the Rockefeller Foundation and Arup. The framework uses four dimensions, and a series of indicators to characterise city resilience.

Right
Aspects of Hull resilience under each of the the four dimensions

Infrastructure and Environment

- Environment and climate change - balancing complex development, economic and environmental needs (Q10)
- Hull has the highest total flood risk envelope outside Thames Estuary. Radical solutions may be required in the face of increasing sea level rise
- In face of more extreme events, balancing schemes to reduce risk versus building in resilient and adaptable solutions
- Critical infrastructure - maintaining power, water, transport and other key services
- Major industrial water users: in particular petro-chemical and health care - a challenge and an opportunity

Economy and Society

- Wages 10% lower than the regional average, and >20% lower than UK average
- 32,500 Humber business at risk of flooding
- Attracting and retaining skilled workers will be important for future growth -
- Economic activity is above the within Yorkshire and Humber average, and rising
- Critical that Hull seen as climate ready and resilient to support the recent upturn
- Significant housing needs to be balanced with water sensitive design
- An opportunity to establish water-resilience as part of Hull's USP

Health & Wellbeing

- Hull is the 3rd most deprived local authority in England (out of 326)
- It has high mental health and low life expectancy compared to national average
- Hull has relatively high unemployment and low qualifications
- Engagement with water issues is low - with low uptake of flood warning and problems with pollution of watercourses
- Overall Hull is an area of high socio-spatial vulnerability to climate risks
- These factors offer a opportunity to look for water resilience solutions that deliver significant health & well-being outcomes

Leadership and Strategy

- Clear partnership vision working - this is being progressed through the LWWP
- Integrated cross-sector approaches
- Governance and finance: the scale of challenge may require alternative approaches such as have been pursued for projects such as Thames Tideway
- Building the economic case - including ensuring equity amongst rural/urban areas and across different demographics
- Gaining support from DEFRA, OFWAT, DCLG and other regulators for alternative approaches
- Aligning with other programmes - see Q12

CATCHMENT OVERVIEW

Hull is located at the southern end of the River Hull Catchment¹, which stretches north to where the first chalk springs emerge from the Yorkshire Wolds. It sits alongside the Humber Estuary, which in turn is part of the wider Humber River Basin District:

The Humber Estuary is a Site of Special Scientific Interest (SSSI) with multiple other designations under UK, European and International law. Areas of the Hull catchment are also SSSIs, in particular the upland chalk streams. For more detailed information on the Hull Catchment itself refer to the map opposite.

Hull Catchment itself refer to the map opposite.

>20%
Of England's land drains through the Humber Estuary

1metre
Forecast sea level rise to 2110

680mm
average annual rainfall

>250km
Coastal defences around the Humber Estuary

PARTNERSHIP RESPONSIBILITY FOR THE HULL WATER ENVIRONMENT

The Environment Agency (EA)

Government Agency responsible for regulating, habitats, water quality, groundwater abstraction, major land drainage, coastal and fluvial flood defences. Has over-arching responsibility for all flood risk.

Yorkshire Water

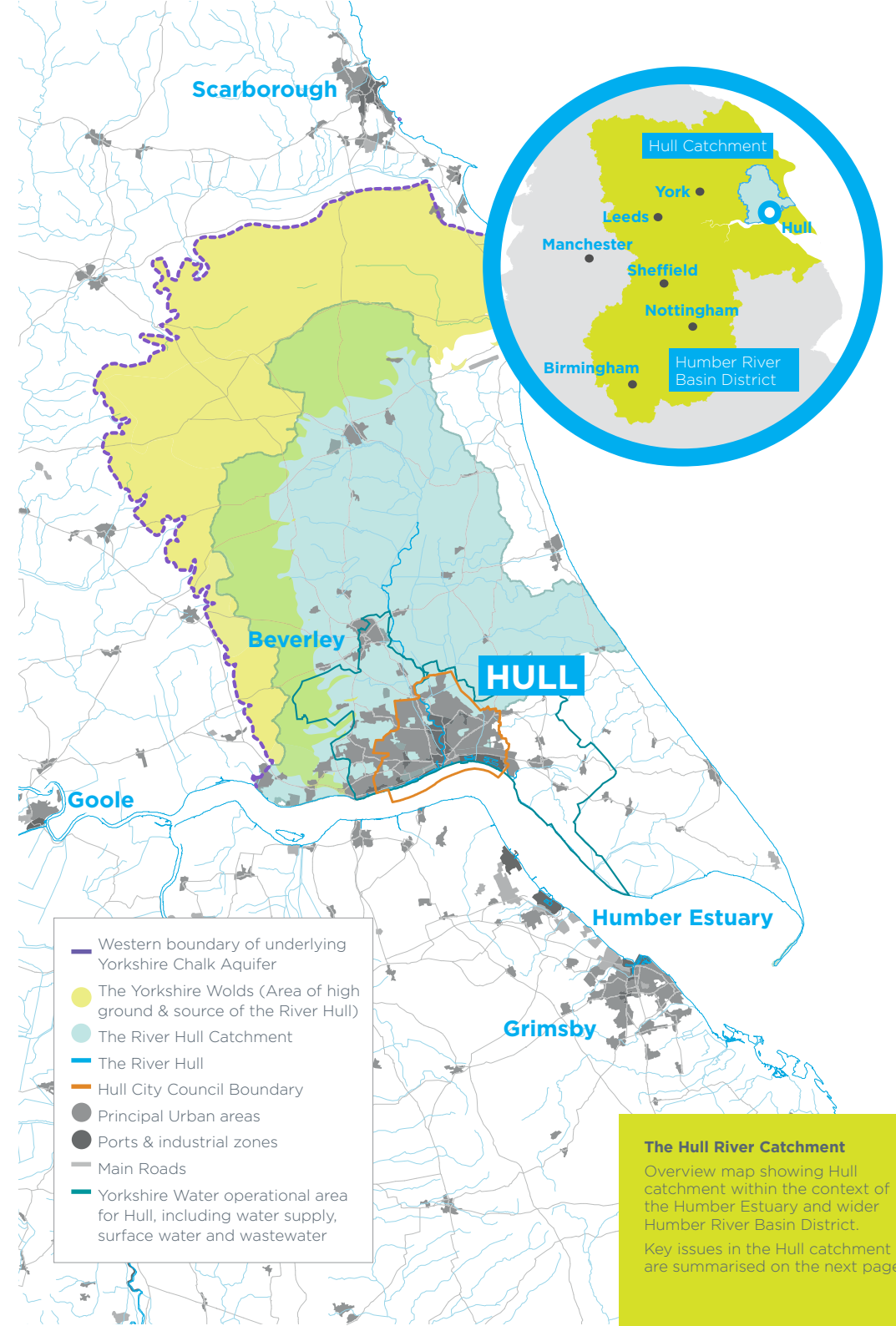
Private-sector company responsible for public water and wastewater services - including surface water drainage - across Yorkshire. Regulated by the Office of Water Services (OFWAT).

Hull City Council & East Riding of Yorkshire Council

Responsibility for Strategic Flood Risk Assessments and control of planning and development. Increasing responsibility for local food risk since the Flood & Water Management Act 2010 is driving more collaboration with the EA and Yorkshire Water.

Other Key Organisations within the Hull Catchment

Within the Hull Catchment the Inland Drainage Board (land drainage), and the Marine Management Organisation (regulation of the marine environment) also have an key role. Refer also to Question 11.



The Hull River Catchment
Overview map showing Hull catchment within the context of the Humber Estuary and wider Humber River Basin District. Key issues in the Hull catchment are summarised on the next page.

WATER CHALLENGES AT CATCHMENT SCALE

Topography & Geology

The catchment is underlaid by the Yorkshire Chalk Aquifer. The springs feeding the River Hull rise in Yorkshire Wolds, a curved ridge of well-drained chalk that runs northwards from west of Hull then east to Flamborough Head.

The low lying land around the city was historically tidal marshland. It is very flat and made up of relatively impermeable tidal deposits.

This natural topography, coupled with the higher-level docks and coastal defences to the south, creates a 'bowl effect' preventing natural drainage of the city.

Land Use & Development

Productive agricultural land is key to the local economy.

In the upper catchment the well-drained areas are used for arable and livestock farming. The reclaimed marshland lower down the catchment provides very high quality arable land, surrounding the low-lying urban areas of Hull.

There is increasing pressure on land use including developing ports and industrial areas to support the economy.

There is increasing pressure on pumped drainage systems supporting agriculture, critical infrastructure and urban development. Maintaining this system needs to be balanced with an increasing need to find ways to slow the flow of water into the city

Water Resources & Supply

Raw water for Hull is supplied from surface water and from ground water from the underlying Yorkshire Chalk aquifer. The aquifer is recharged in the upper catchment from water falling on the Wolds. Groundwater abstraction is limited by the need to avoid saline intrusion from the estuary.

Raw water quality is managed through source protection zones, but these are under increasing pressure from development and agricultural practice, with nitrate contamination being a particular issue.

Ageing infrastructure is also becoming a challenge.

Promoting Nature-Based Solutions

Due to the nature of the reclaimed landscape there will always be a need to manage the water environment using a variety of green and 'grey' solutions.

However, despite significant challenges based on Hull's unique catchment characteristics, there are many opportunities for nature-based solutions to water resilience, such as improved land management and natural flood management across the catchment, and innovative approaches within the city (see page 15)

These need to be balanced with the complex needs of urban and rural development, ongoing land drainage strategy and the need to protect sensitive environmental habitats.

Innovative Funding & Investment

The unique nature of the catchment raises a number of challenges that require innovative approaches to governance, funding and delivery that are already being considered by the city and LWWP.

A key challenge is in balancing the needs of rural and urban communities and ensuring equity of investment and impacts between 'who benefits' and 'who pays'. (both positive and negative).

LWWP partners have recently collaborated to deliver flood alleviation schemes to the west of Hull (see Figure 3).

Going forward such approaches may involve creating a catchment-scale case for investment.

100%

Urban areas less than 10m above sea level

48%

Rented housing versus 32% in UK

14%

Aquifer recharge from rainfall is abstracted

92%

East Riding is agricultural land

£310m

Siemens investment in renewables in Hull

CITY WATER CHALLENGES

Hull developed around the opportunities for connectivity and trade offered by ports at the confluence of the Hull and Humber. This highly productive landscape has been created by reclamation of tidal marsh and intense water management.

Its coastal location continues to underpin the economy and major opportunities going forward, but Hull also faces particular challenges due to its low-lying coastal context. With parts of the city below sea-level and a catchment that drains towards the estuary (Figure 5, page 15), it will always be a highly-managed landscape. The water systems are illustrated opposite. Key water challenges are summarised on the next page. Refer to Question 10 for wider catchment context.

>95%
Area of city below highest tides

100%
City reliance on pumped systems



WATER CHALLENGES AT CITY SCALE

Flood risk from multiple sources

Coastal protection must balance sea level rise, coastal erosion and habitat protection, flood storage, navigation and industry.

The city is fully reliant on pumping to remove surface water; existing surface water systems are at or near capacity.

Solutions to keep water out of the city are politically sensitive requiring loss of prime agricultural land and actions across administrative boundaries.

Options for green-blue solutions are limited (see also pp 16-17).

Future solutions will need to build resilience to cope with more extreme events.

Wastewater treatment

A single wastewater treatment works takes all sewage flows from the city and is fully reliant on pumping.

Much of the surface water landing on the city flows into the combined system, including most of the watercourses which have been culverted.

Much of the infrastructure is ageing and at or near capacity.

Options for disconnecting surface water and reducing sewage flows are complex and limited due to the nature of the catchment (see also Q10).

Radical solutions will be required.

Water resource and supply

Water is supplied both from surface water abstraction and via abstraction from the underlying chalk aquifer. Rainfall is low but the main challenge is in protection of water quality (see pages 16-17).

Within the city the aquifer is protected by an impermeable layer but there are gaps that present potential pathways for contamination.

Source protection zones are increasingly under pressure from development and some have been compromised. Green-blue solutions encouraging infiltration or localised treatment will need to take into consideration risk to groundwater contamination.

Some of Yorkshire Water's largest water users are based in the City.

Water Sensitive Development

Hull has the most comprehensive Strategic Flood Risk Assessment in the UK, based on detailed understanding of integrated drainage systems to inform future development.

There will be increasing pressure on land use as the city grows, especially as Hull has agreed to accommodate housing growth for the East Riding area. Balancing this with making space for water will be a major challenge.

Retrofit of existing building and public realm is a challenge and an opportunity for the city.

Implementation will require innovative approaches to land use planning, urban design and development, including new planning mechanisms, incentives and design guidelines.

Community Engagement

Despite the extent of flood risk and impact on 9,000 properties during the 2007 floods, perception and awareness of risk is still relatively low, with only 4% of eligible households signed up to flood warnings.

There is a need to reconnect the city with it's water story, to build a shared understanding, particularly between urban and rural communities and also engaging immigrant and disadvantaged communities.

This can increase uptake of resilience measures, acceptance and participation in alternative solutions, facilitate behaviour change and may also influence considerations of 'willingness to pay'.

95-98%

Dwellings at high risk of flooding

84%

Surface water flows to combined sewers

15%

Hull's potable water demand is industrial

9,920

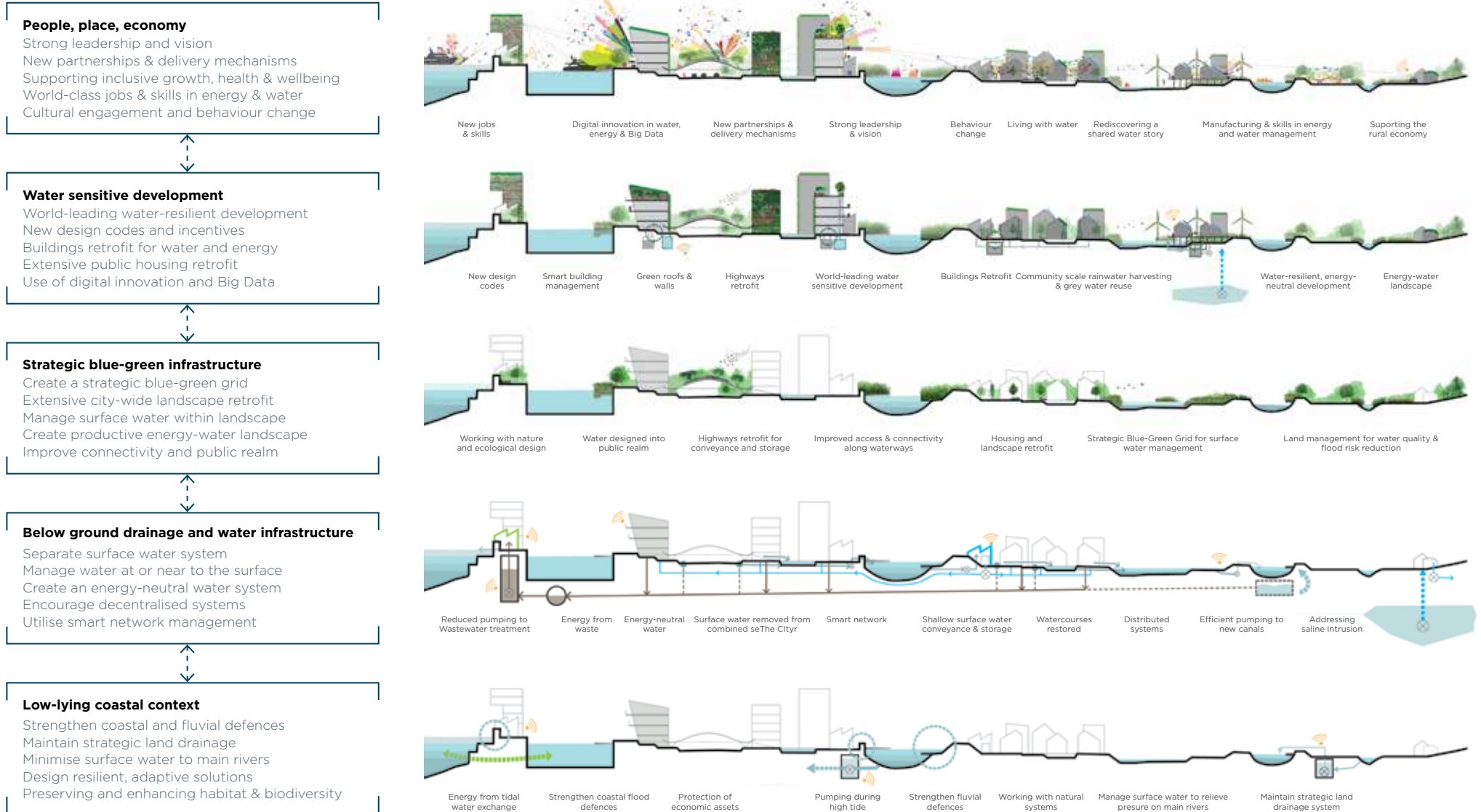
Planned homes in the City over next 15 years

4%

Take up of flood warning service

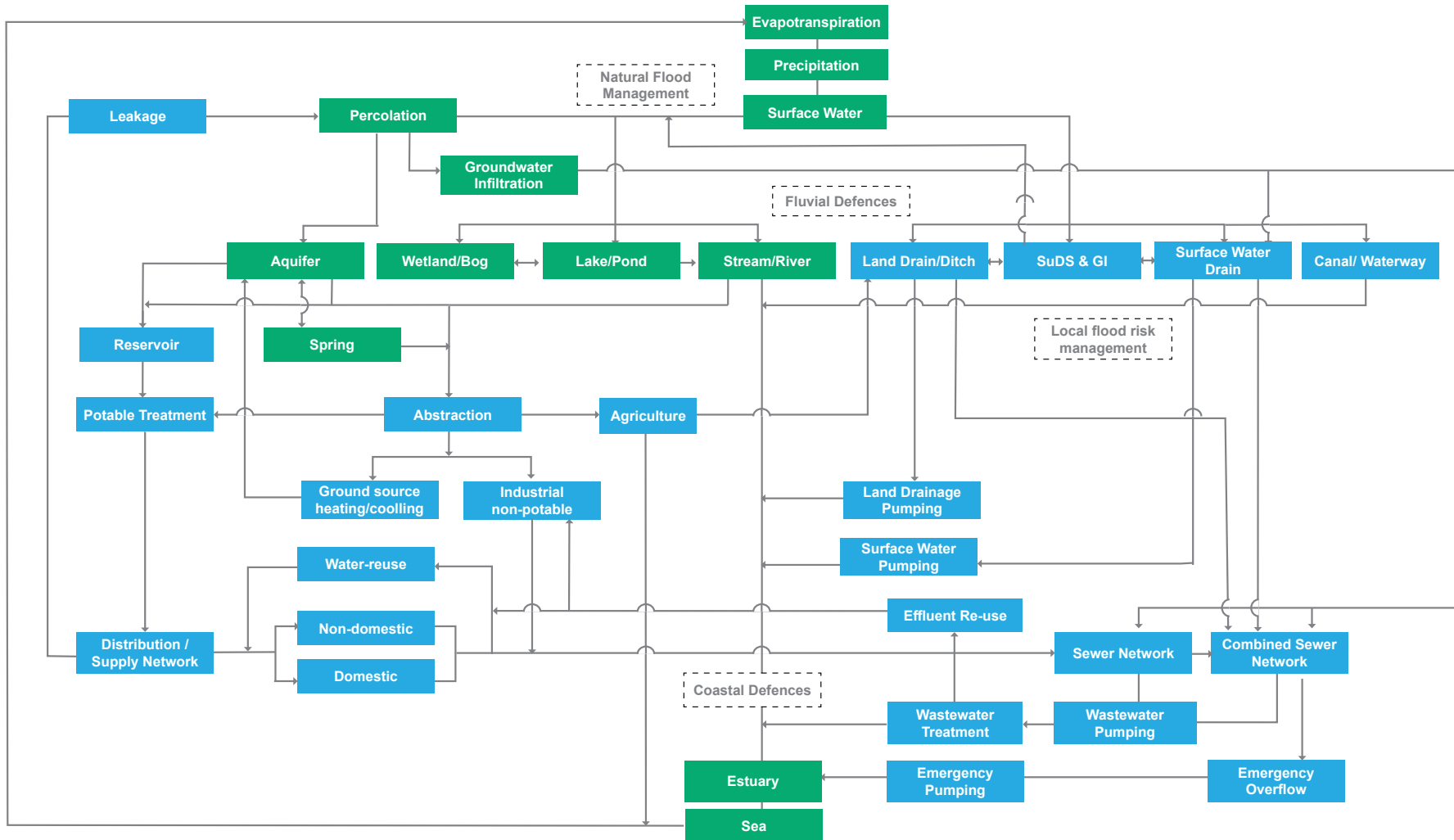
THE HULL WATER ENVIRONMENT

The diagram below illustrates the key systems making up the water environment in Hull. Alongside each system are some of the emerging water-resilience strategies being explored by the Living with Water Partnership.



THE CITY WATER CYCLE

The diagram below illustrates a high level summary of the water cycle in Hull, including the key interactions. Green boxes indicate natural processes and the blue indicate human-made elements. It is acknowledged the boundaries between these categories are particularly complex in Hull where so much of the landscape has been highly modified over time. The dotted boxes acknowledge the fundamental role that flood management plays controlling flows between different parts of the cycle.



STAKEHOLDER ENGAGEMENT

Collaboration with the Rockefeller Foundation and Arup to develop the CWRF is being led by a City Team from Hull City Council and East Riding of Yorkshire Council. The Team includes cross-sector representation to facilitate effective engagement across the various city departments and wider stakeholders – ensuring a fully integrated and efficient approach.

The diagram opposite illustrates the governance structure by which the Hull City Team is working the Living with Water Partnership to facilitate engagement with cross-sector stakeholders, citizens and the wider community throughout the process



THE CITY AND ITS PARTNERS ARE COMMITTED TO AN AMBITIOUS RESILIENCE PROGRAMME - WORKING TOGETHER WITH BUSINESSES AND COMMUNITIES TO DELIVER LASTING IMPACT AND TRANSFORMATIONAL CHANGE.

