



Concepts of Resilience & Security in Water Management

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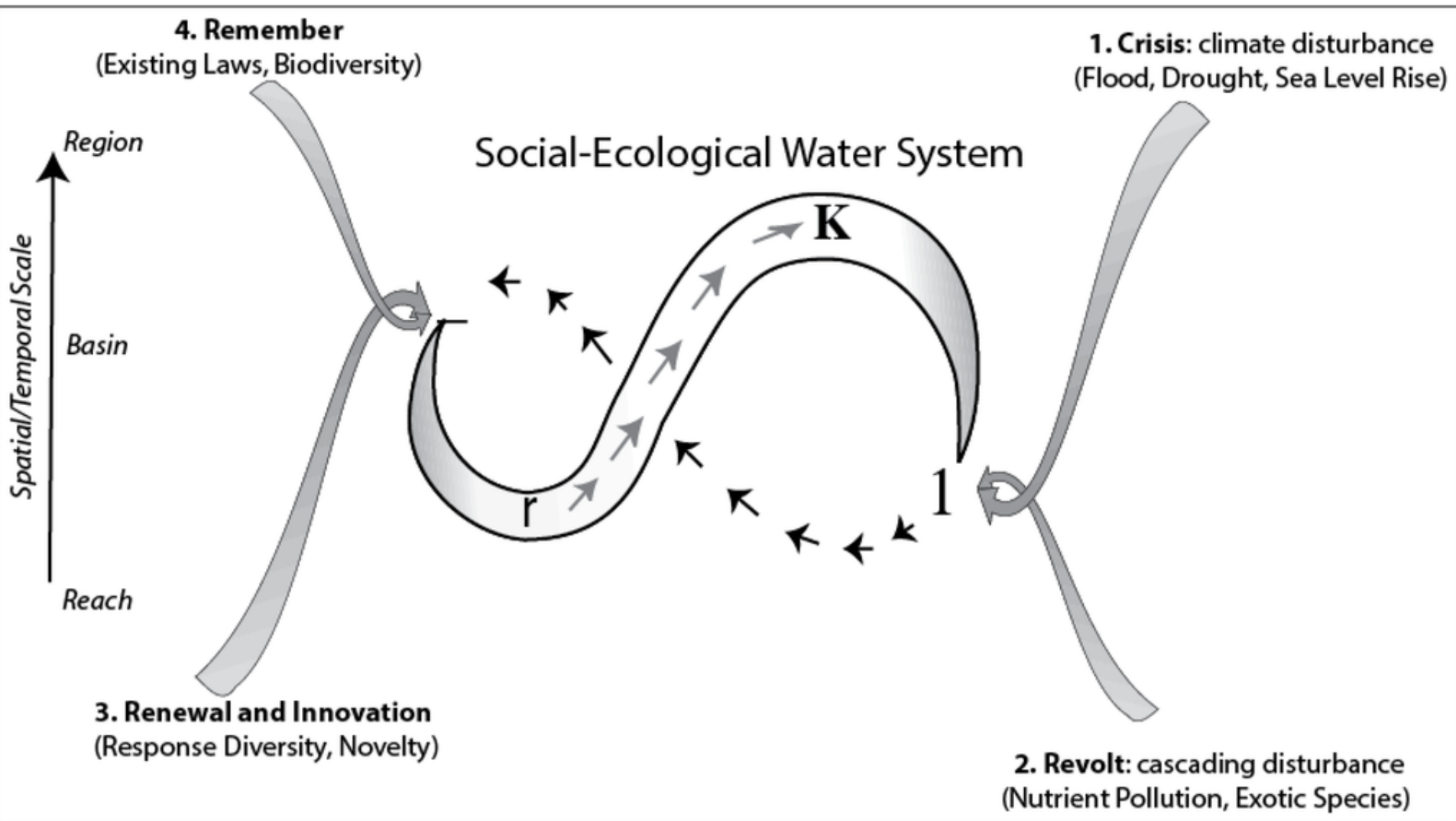


100 RC DEFINITION OF RESILIENCE USED BY ALL DESIGNATED CITIES

URBAN RESILIENCE

Is the capacity of **individuals, communities, institutions, businesses, and systems** within a city to survive, adapt, and grow no matter what kinds of chronic **stresses** and acute **shocks** they experience.





Engineering resilience for water systems relies on understanding and manipulating the following four basic abilities:

- The ability to **monitor**. Knowing what to look for, or being able to monitor that which could seriously affect the system's performance – positively or negatively. The monitoring must cover the system's own performance as well as what happens in the surrounding environment.
- The ability to **respond**. Knowing what to do, or being able to respond to regular and irregular changes, disturbances, and opportunities by activating prepared actions or by adjusting current mode of functioning.
- The ability to **learn**. Knowing what has happened, or being able to learn from experience, in particular to learn the right lessons from the right experience.
- The ability to **anticipate**. Knowing what to expect, or being able to anticipate developments further into the future, such as potential disruptions, novel demands or constraints, new opportunities, or changing operating conditions.

These are increasingly sophisticated functions, together at the frontiers of what is possible, both technically and socially.



The Bristol story

Resilience = **Sustainable development for all**
in the face of
future uncertainty

HOME SCENARIO X SCENARIO Y THE PROJECT YOUR IDEAS



FUTURE
BRISTOL
LOW CARBON
2050



Leadership and management



Knowledge



Disease pandemic



Livelihoods and employment



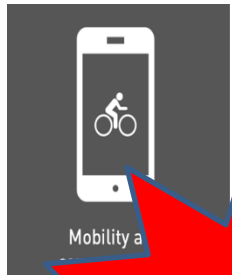
Stakeholder empowerment



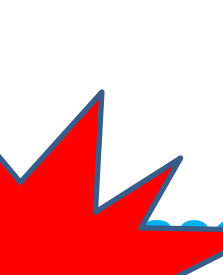
Short term political and funding cycles



Possible shocks



Mobility and transport



Flooding

Organisational



Security



Austerity cuts



Critical services



Protective infrastructure



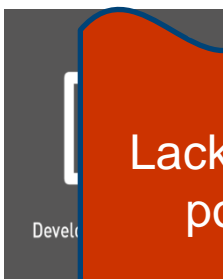
Identity and mutual support



Finance and funds



Leadership and management



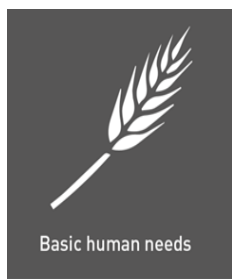
Develop

Lack of local powers

Inequalities in health, housing and education



Health and emergency services



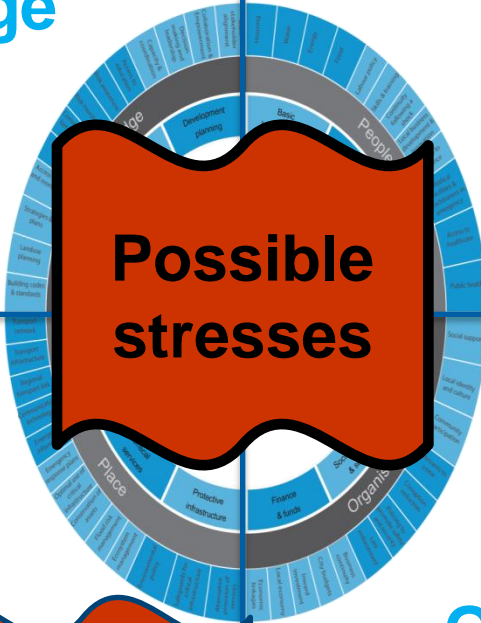
Basic human needs

Skills gap for future job market

Knowledge

People

Vulnerable food supply chain



Possible stresses

Disconnected areas of city

Place

Organisation

Community tensions



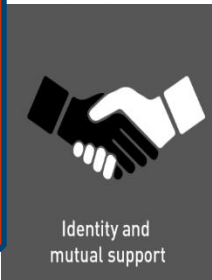
Criti

ucture

Lack of neighbourhood facilities

Poor air quality

Low capacity to co-create local solutions



Identity and mutual support



Finance and funds

A co-creative process to develop the Strategy



150

meetings / interviews



25

presentations



1,600

people



7

workshops

THE MAIN GROUPS CONVENED THROUGH THIS PROCESS WERE:

SENIOR COUNCIL OFFICIALS ACROSS DEPARTMENTS OF BRISTOL CITY COUNCIL

COUNCIL OFFICIALS FROM NEIGHBOURING LOCAL AUTHORITIES

CATEGORY 1 RESPONDERS (LOCAL RESILIENCE FORUM, EMERGENCY SERVICES)

CATEGORY 2 RESPONDERS (UTILITY COMPANIES)

SENIOR ACADEMICS INTERESTED IN RESILIENCE

THIRD SECTOR ACTORS

COMMUNITY LEADERS AND ADVOCATES

PROFESSIONALS WORKING IN THE PRIVATE SECTOR

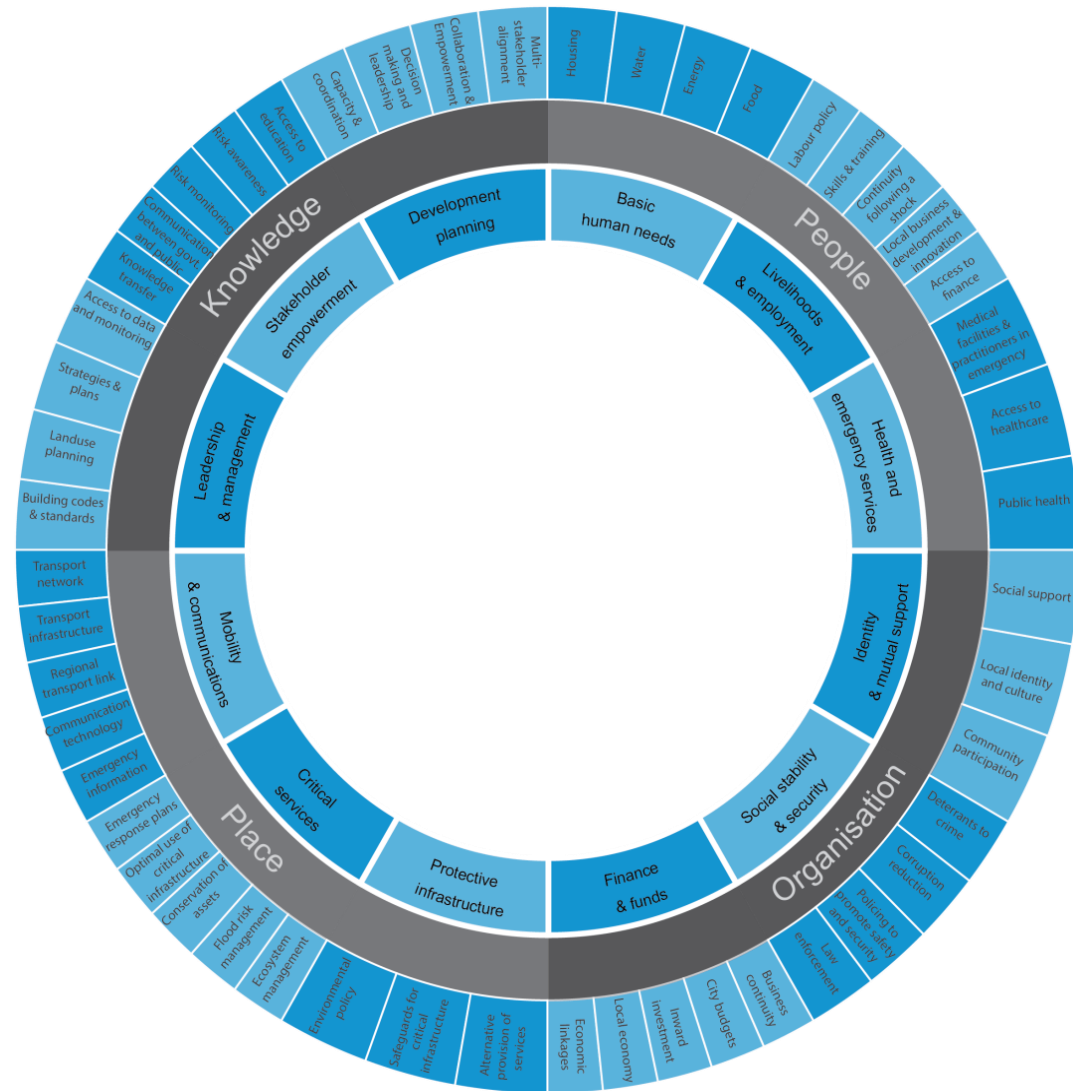
NETWORK REPRESENTATIVES

Understanding resilience

City Resilience Framework

A tool to look at a city's resilience through the lens of:

- 4 systems
- 12 factors
- 48 sub-factors

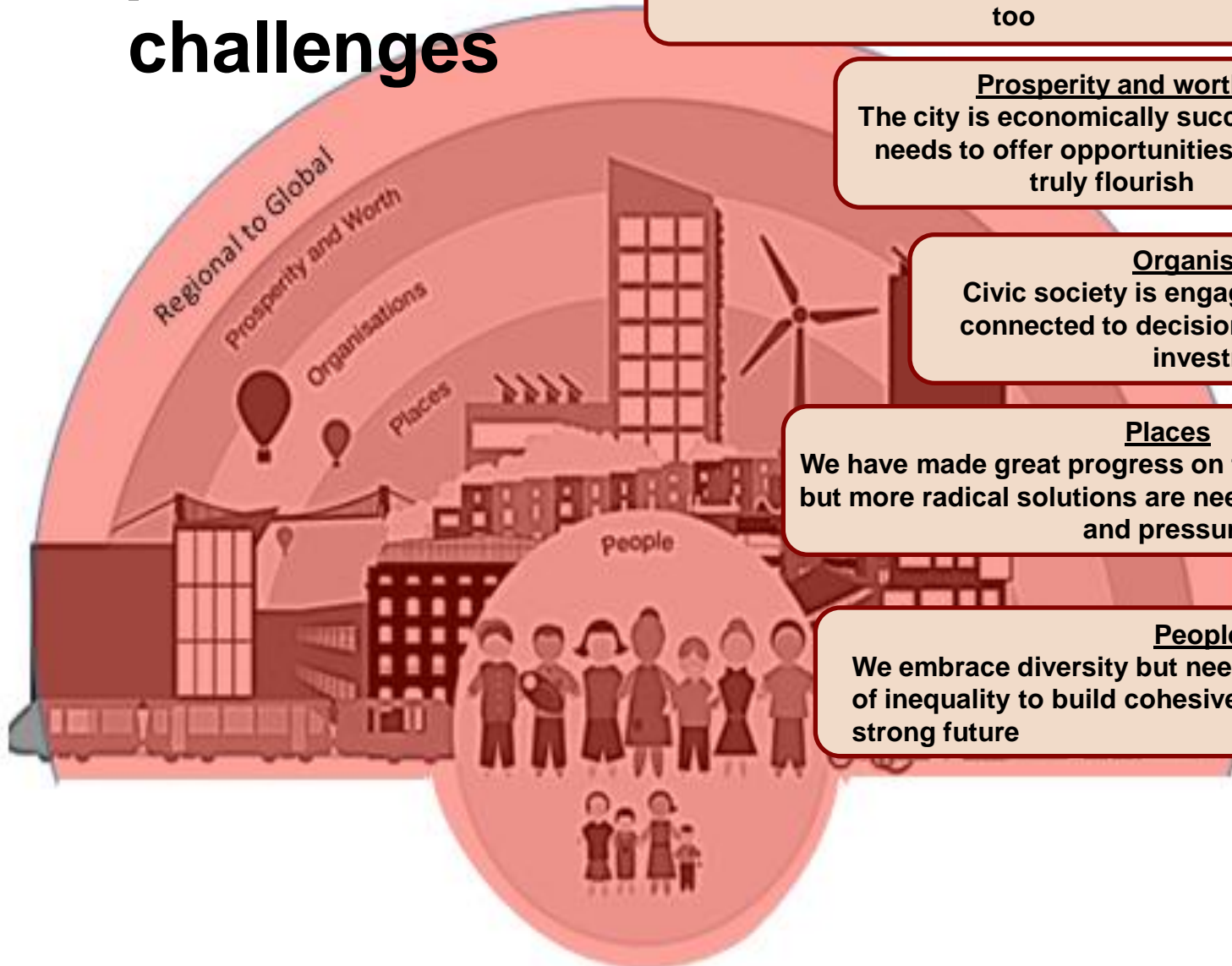


Bristol Resilience Strategy

- Vision for 2066
- Five resilience paradoxes/scales/challenges
- Five resilience pillars
- Five ways of working
- 40 resilience actions



Five resilience paradoxes/ challenges



Regional to Global

We focus on the needs of Bristol and its citizens, but must address regional and global influences too

Prosperity and worth

The city is economically successful but needs to offer opportunities for all to truly flourish

Organisations

Civic society is engaged but needs to be connected to decision making and future investment

Places

We have made great progress on future-proofing the city, but more radical solutions are needed to adapt to change and pressure

People

We embrace diversity but need to tackle root causes of inequality to build cohesive communities with a strong future

*tional Water
y Network*



Five pillars of resilience



Fair

Every person living in Bristol has the assets and opportunities to enjoy a good quality of life.



Liveable

The city centre and neighbourhoods are great places for people of all ages to live, work, learn and play.



Sustainable

The city and region prosper within environmental limits through adopting new behaviours and technology.



Agile

Bristol citizens and leaders make agile decisions based on shared priorities and real-time information.

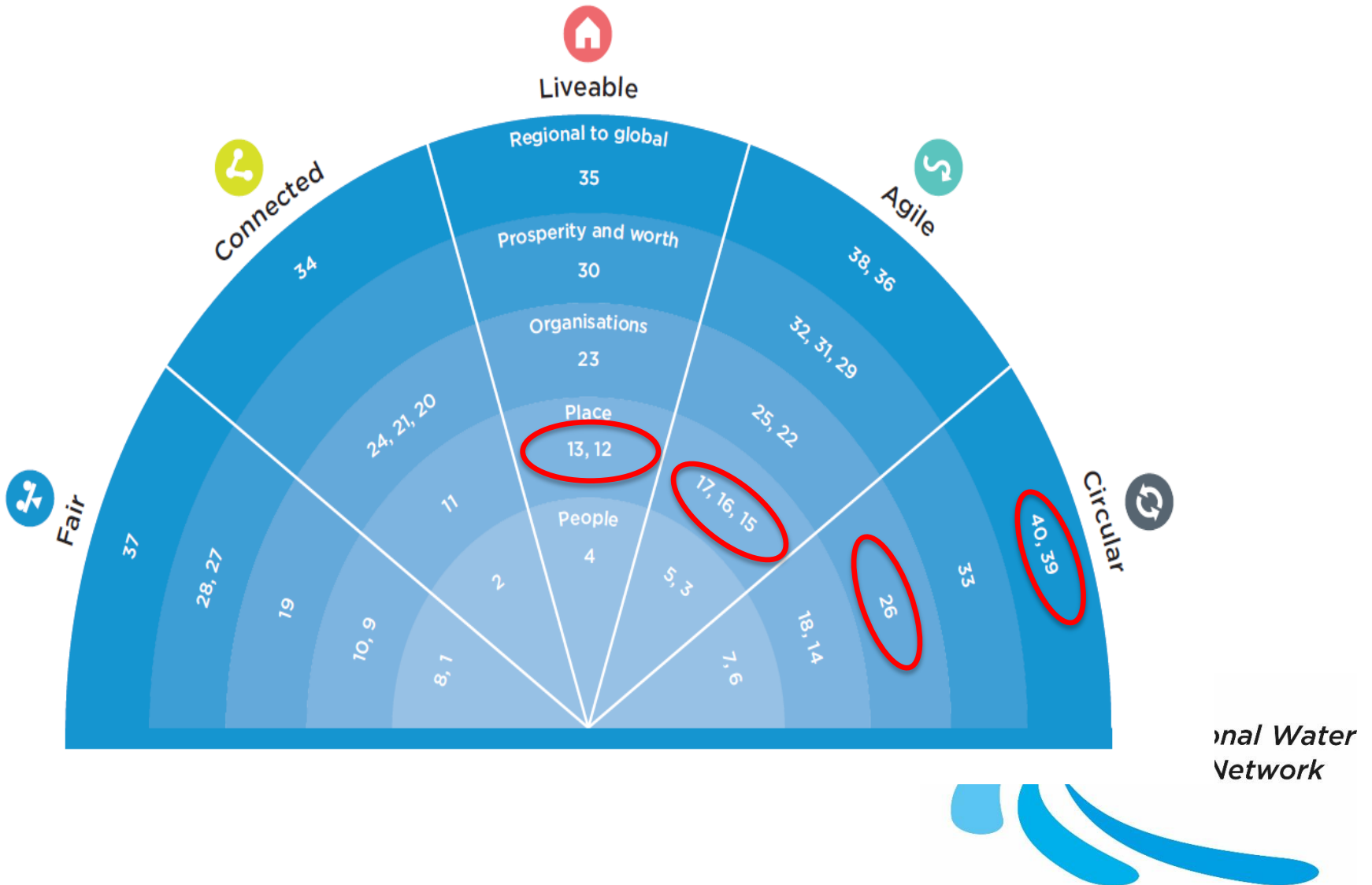


Connected

A strong network of local communities and organisations promotes trust, cooperation and shared action across the city.



40 transformative actions



8

Community-based adaptation



Communities that are self-organised in day to day life are inherently better prepared to respond to, and recover from, unexpected events in their neighbourhoods.

Community based adaptation (CBA) has been pioneered in developing countries to build capacity in vulnerable and marginalised communities to become more resilient to climate change impacts. An important lesson from CBA practices is that a multi-level, cross-sectoral approach involving a range of different stakeholders - including the residents themselves - is necessary to develop adaptive capacity and build long term resilience.

This action builds on the principles of CBA and experience from a number of existing projects and initiatives in Bristol, the south west and other cities around the world. It aims to develop a more integrated and inclusive approach to working with communities to empower them with the knowledge, confidence and resources to take action when affected by local shocks.

Delivery

- Potential partners: Bristol City Council Civil Protection Unit, Cities of Service team, Local Resilience Forum, Groundwork (funded by Big Lottery Fund), Bristol Resilience Network, Community Development teams, UL Cabinet Office.
- Timescale: Short term

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Climate change adaptation plan



As a signatory of the Compact of Mayors, Bristol has a long-established approach to climate change mitigation (see action R4). This action will build on this success and develop an approach to adaptation to climate change.

A plan will be developed to future-proof the city by identifying the major climate hazards and their potential impact, a framework for adaptation, and identification of strategies to build climate resilience. Consideration of the issues will be required at a city scale with actions targeted at a local scale with their benefits well communicated.

Delivery

- Potential partners: Bristol City Council
- Timescales: Short-term

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Manage our future flood risk



The flood event with the potential for most severe damage to the city centre is a tidal flood. Bristol's Central Area Flood Risk Assessment (CAFFRA) predicts that the current trend of rising sea levels will accelerate due to the impact of climate change, causing the likelihood of tidal flooding in central Bristol¹⁸.

A strategy is being developed to recommend an adaptive programme, identify when flood risk management interventions are needed and examine how they will be funded.

Delivery

- Potential partners: Bristol City Council Flood team, Environment Agency, Local Enterprise Partnership
- Timescale: Medium term

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My wild rainwater street



Greening local neighbourhoods helps to make our City more liveable, whilst also improving local biodiversity, enhancing sustainable drainage and reducing the urban heat island effect. Bristol will build on existing initiatives, including Avon Wildlife Trust's My Wild Street, Wessex Water's Rainwater City and Emblerton Road SuDs, to develop an approach that communities across the city can engage in.

Delivery

- Potential partners: Green Capital Partnership, Bristol City Council, Avon Wildlife Trust, Wessex Water, Sustrans
- Timescale: Medium term

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Natural Capital Trust



We will support the development of the Natural Capital Trust (NCT) as an innovative mechanism to deliver enhancement in the quality of the natural environment across the West of England region. The NCT will act as a conduit of funds from developers, and from potential beneficiaries of Payments for Ecosystem Services schemes, to support a range of projects which ensure provision of services by ecosystems, enhancing (amongst other things) resilience to the effects of climate change and of the region's infrastructure.

Delivery

- Potential partners: Bristol City Council (and other UAs in the region), West of England Nature Partnership, Health and Wellbeing Board, Local Enterprise Partnership, utility providers, developers, English Nature, Environment Agency, Highways Agency
- Timescale: Medium term

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Adaptation & Resilience Framework for the Bristol Avon Catchment



The Adaptation & Resilience Framework for the Bristol Avon Catchment is a collaborative initiative to address climate change adaptation and economic austerity by integrating cross-sectoral adaptation actions into spatial planning at a catchment scale. It will address relevant Global Sustainable Development Goals at a local scale and highlight where the enhancement of our regional natural capital could be made in multiple distributed locations, to deliver multi-beneficial outcomes from collaborative investments. By integrating the framework into existing work streams, operational and investment plans, development decisions can be made based on wider identified risks, with wider costed solutions and routes to delivery that enhance the value of existing and future investments in the region. The ultimate aim is to create an attractive sustainable place for future generations, with a strong regional economy and enduring infrastructure supported by sustainable agriculture and resilient natural capital.

Delivery

- Potential partners: Wessex Water, Environment Agency, West of England Nature Partnership, BCC
- Timescales: Medium term

Now let's talk about a few specific examples:



Nature-Based solutions for improving Urban Resilience through Green Infrastructure



The US Environmental Protection Agency (US EPA, 2009) defines GI as:

... an array of products, technologies, and practices that use natural systems – or engineered systems that mimic natural processes – to enhance overall environmental quality and provide utility services. As a general principle, Green Infrastructure techniques use soils and vegetation to infiltrate, evapotranspire, and/or recycle stormwater runoff. When used as components of a stormwater management system, Green Infrastructure practices such as green roofs, porous pavement, rain gardens, and vegetated swales can produce a variety of environmental benefits. In addition to effectively retaining and infiltrating rainfall, these technologies can simultaneously help filter air pollutants, reduce energy demands, mitigate urban heat islands, and sequester carbon while also providing communities with aesthetic and natural resource benefits.




AGENDA SETTING SCOPING STUDIES

Contributions of green infrastructure to enhancing urban resilience: main report

Consortium

UWE BRISTOL, UNIVERSITY OF ARIZONA, MONASH SOUTH AFRICA, ARCADIS, UNIVERSITY OF SCIENCE AND TECHNOLOGY BEIJING

Date: 30 June 2017



AGENDA SETTING SCOPING STUDIES

Contribution of green infrastructure to urban resilience: case studies from around the world

Consortium

UWE, UNIVERSITY OF ARIZONA, MONASH SOUTH AFRICA UNIVERSITY, ARCADIS, UNIVERSITY OF SCIENCE AND TECHNOLOGY, BEIJING, CHINA

Date: June 30, 2017



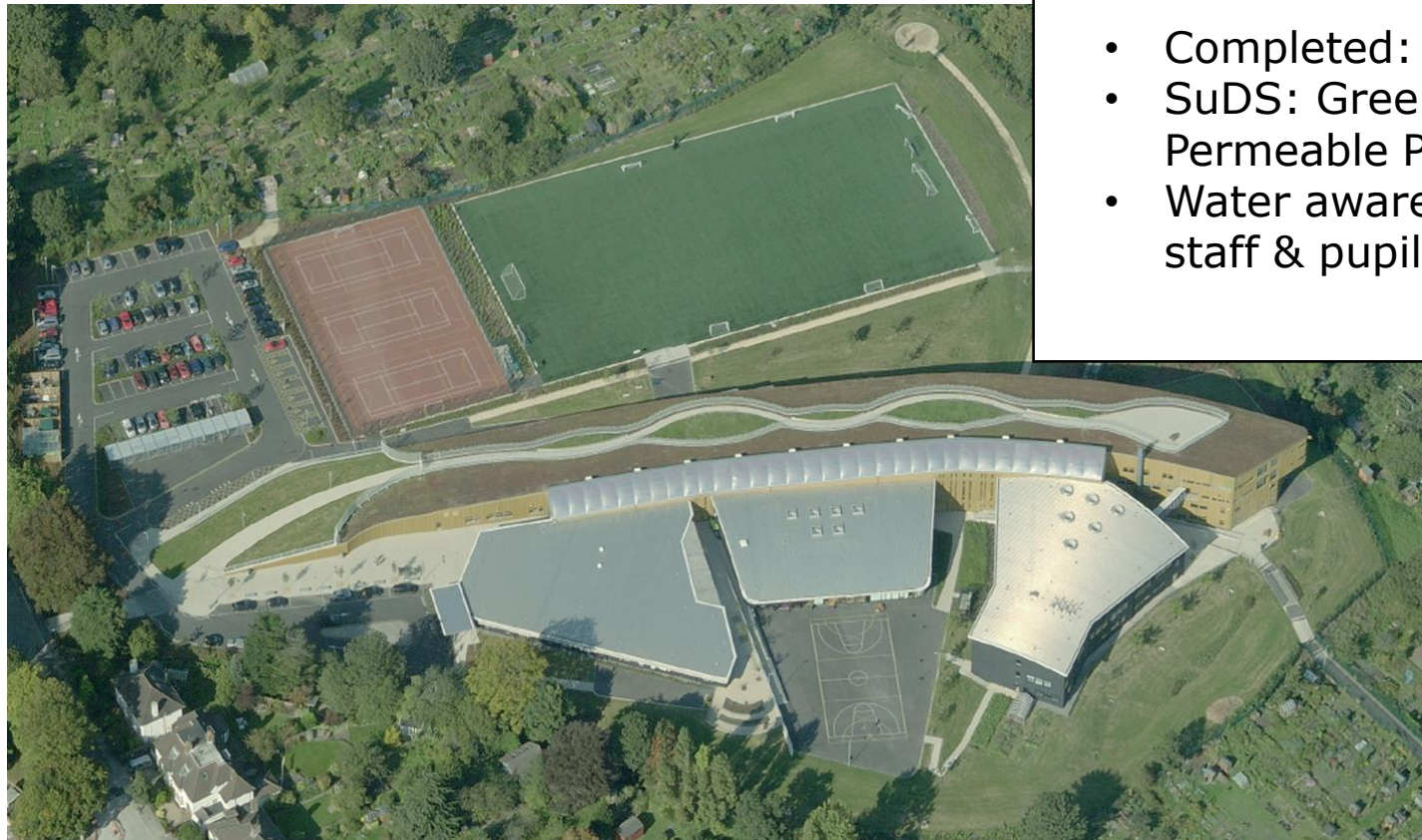
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ork*



1. In cities more users are served per unit length of underground network!
2. Possible (but not yet common) to include water in development planning
3. Green infrastructure: permeable paving, urban green spaces, passive heating and cooling, rainwater harvesting, etc.

Redland Green School, Bristol, UK

- Completed: 2007
- SuDS: Green Roofs, Swales and Permeable Paving
- Water awareness education for staff & pupils

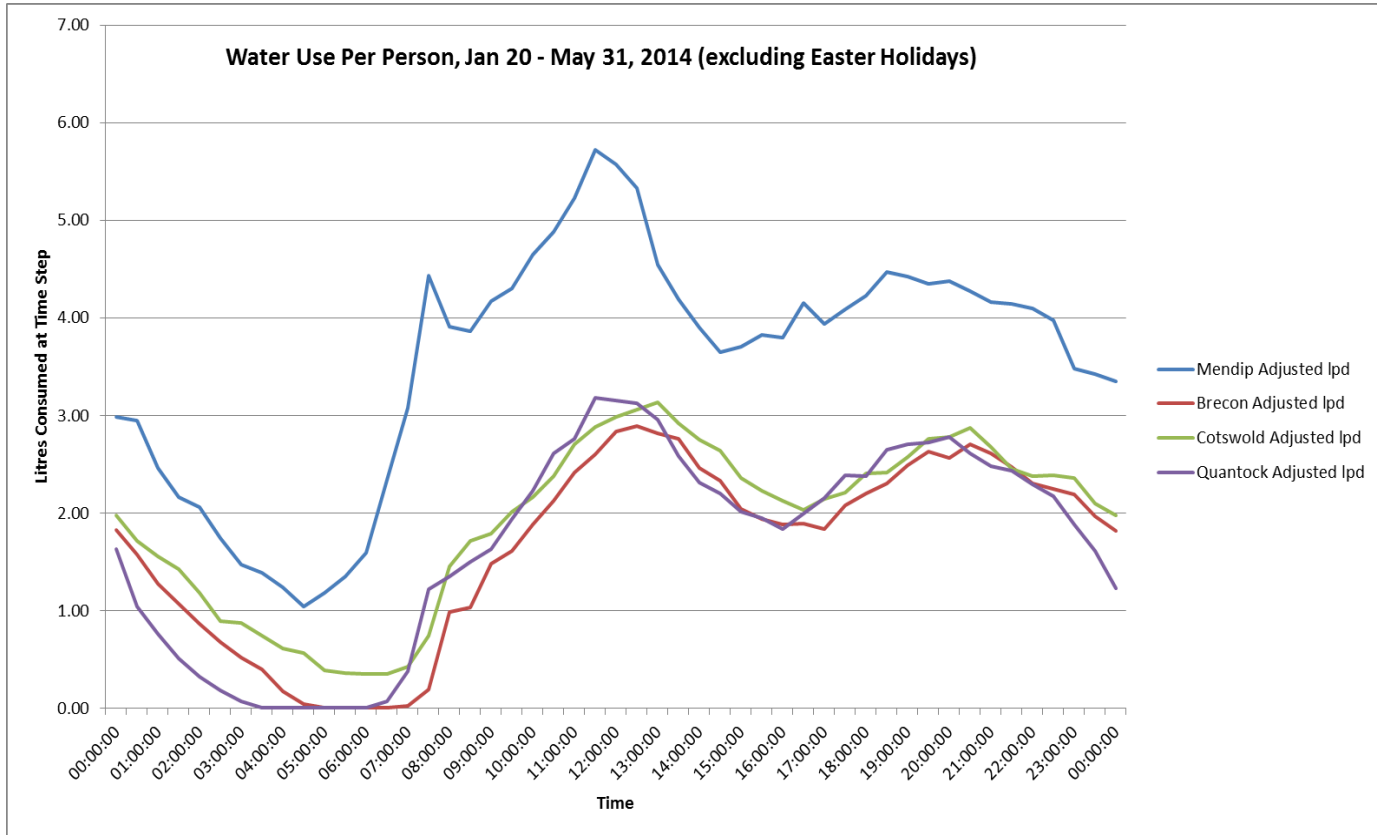


Learning to Work More Effectively with Big Data

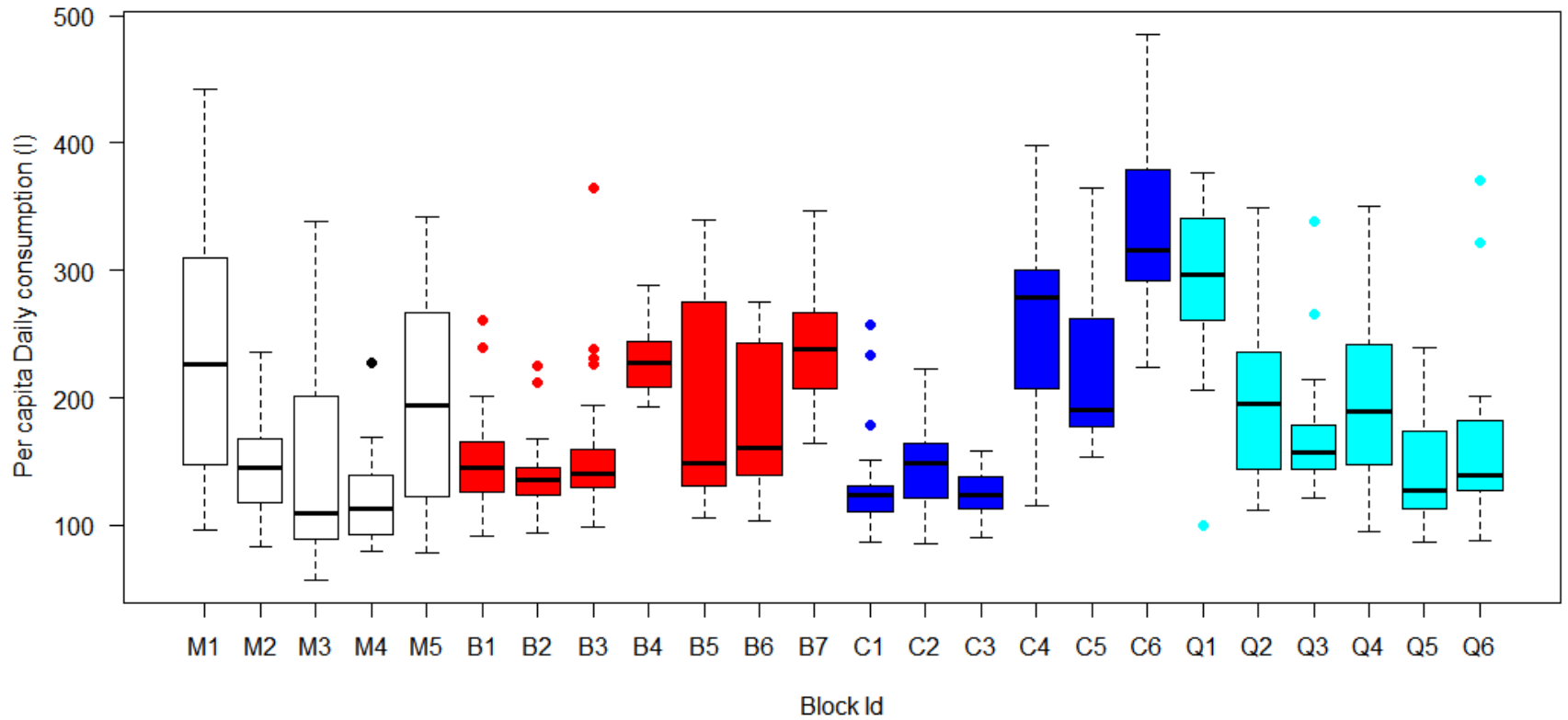


Better data can broker better solutions





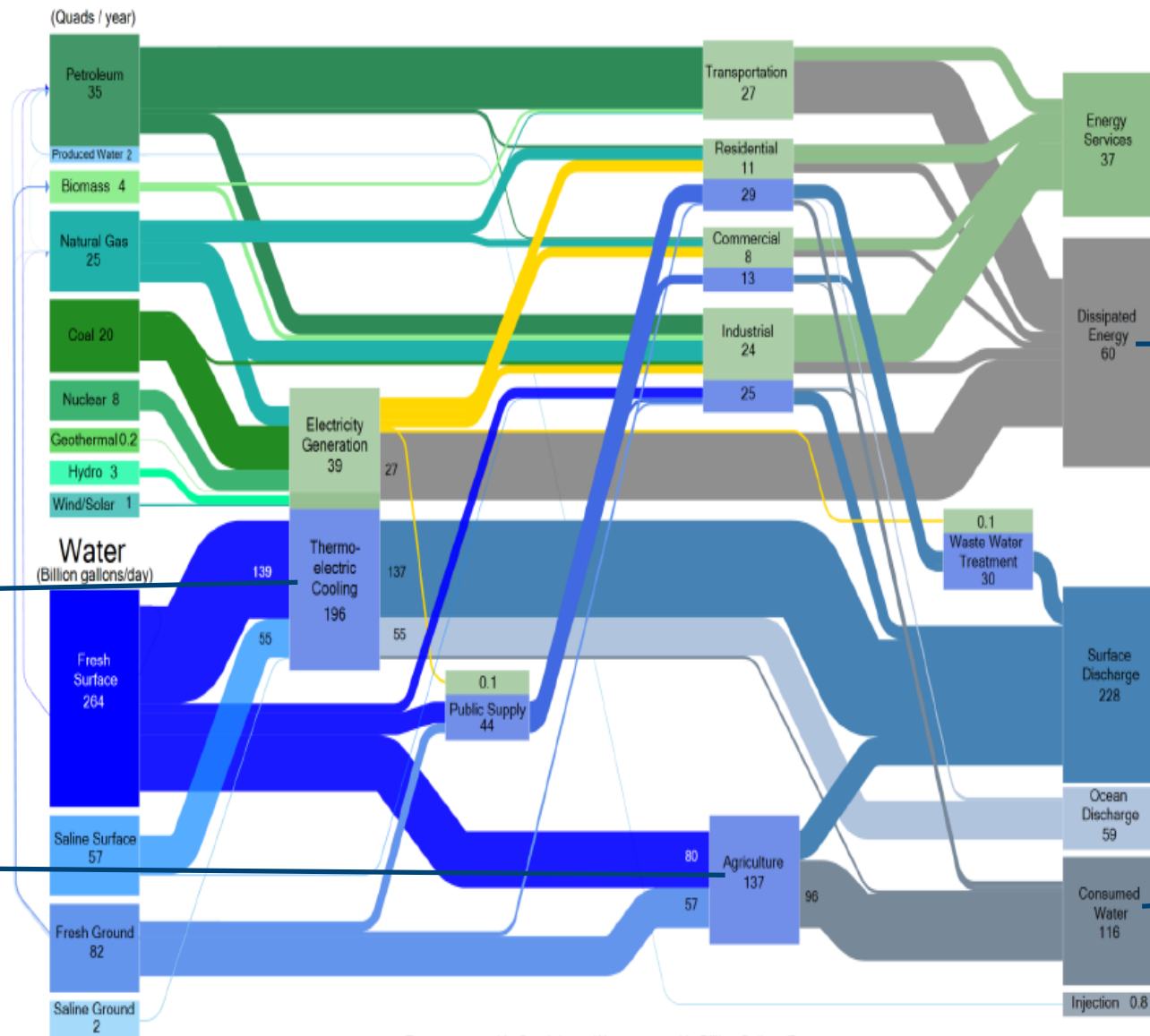
February 2015



Optimising the Water-Energy-Food Nexus for Enhanced Urban Resilience



Water-Energy Flow Sankey Chart



Great inefficiencies in converting thermal energy to electricity

Thermal properties of H2O utilised

Raw material and solvent properties of H2O utilised

'Consumption'?

- ▶ Evaporation from thermo-electric plants
- ▶ Evaporation from agriculture
- ▶ Hydraulic Fracturing

- Since 2009, Bristol Water has used 810-820 kWh/MI put into supply
- Over the past four years, company emissions have been relatively stable at **35,000 tonnes CO2 pa**
- The largest contribution to CO2 comes from the **power required to transfer water across the supply and distribution system.**
- A reduction in the quantity of energy needed to treat water is outlined in the key national strategies from 'Water for Life'
- BW owned Purton solar PV system produced **454,878 kWh of electricity** in 2014/15 resulting in a carbon saving over **244,000 kg CO2.**
- Helping customers save water has reduced usage by **260 million litres** saving **15,000 kg CO2**





Ultimately “resilience” is less about hard engineering in the physical environment and more about soft engineering of what I have elsewhere referred to as the “hydrosocial contract”:

The unique combination of technological, economic, political, cultural and environmental conditions that is relatively stable for a period of time (usually several decades).



“Resilience” will be a function of actions that target the WHOLE social-ecological system, including:

- Better data, including “citizen science”, on critical Ecosystems Services
- More complex in the coastal setting, in part because of scientific and regulatory “silo-isation”; neither terrestrial nor marine exactly, but both.
- blue-green-grey infrastructure to build resilience within these social-ecological systems
- Adaptive governance



YOU are invited to take part in World Water Activities in Bristol, March 21-23, 2018.

The 2018 theme is “Nature-based Solutions for Water”

Get in touch with me (chad.staddon@uwe.ac.uk) if you want to discuss!



www.watersecuritynetwork.org
www.twitter.com/water_network

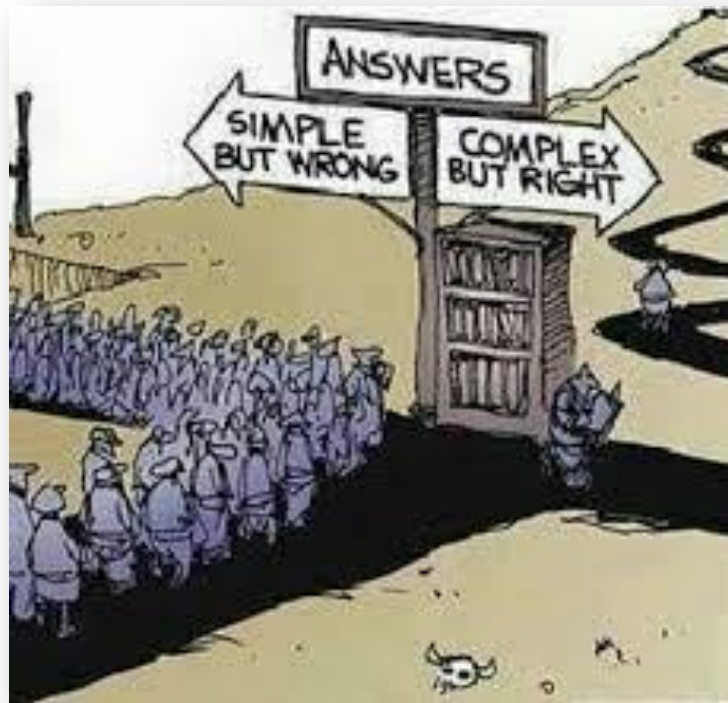
Acknowledgement

The International Water Security Network is funded by Lloyd's Register Foundation, a charitable foundation helping to protect life and property by supporting engineering-related education, public engagement and the application of research.

For more information, see: www.lrfoundation.org.uk



My “Brexit” Slide!



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