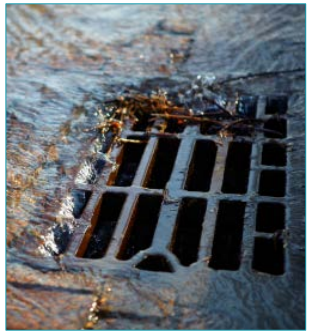
Urban Flood Resilience in an Uncertain Future

urbanfloodresilience.ac.uk @bluegreencities

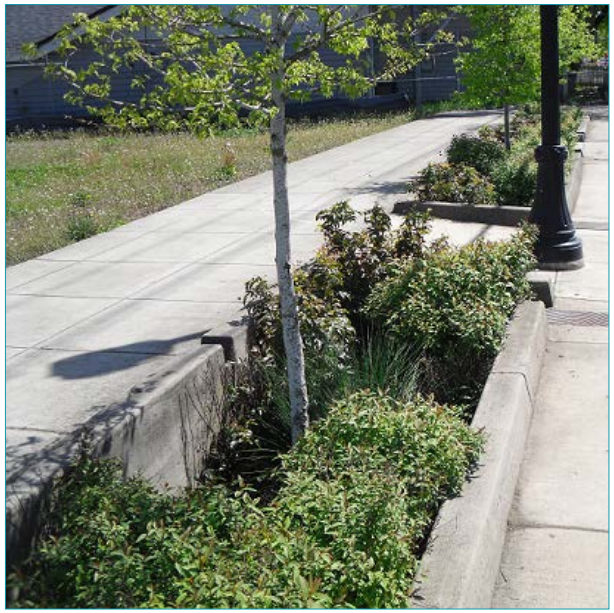
"what is required is a fundamental change in how we view flood management, from flood defence where we protect ourselves to one of resilience, living with and making space for water and the opportunity to get 'more from less' by seeing all forms of water as providing multiple benefits."

Commission of Inquiry into flood resilience of the future titled 'Living with water', March 2015. All Party Group for Excellence in the Built Environment, House of Commons, London, p. 32.

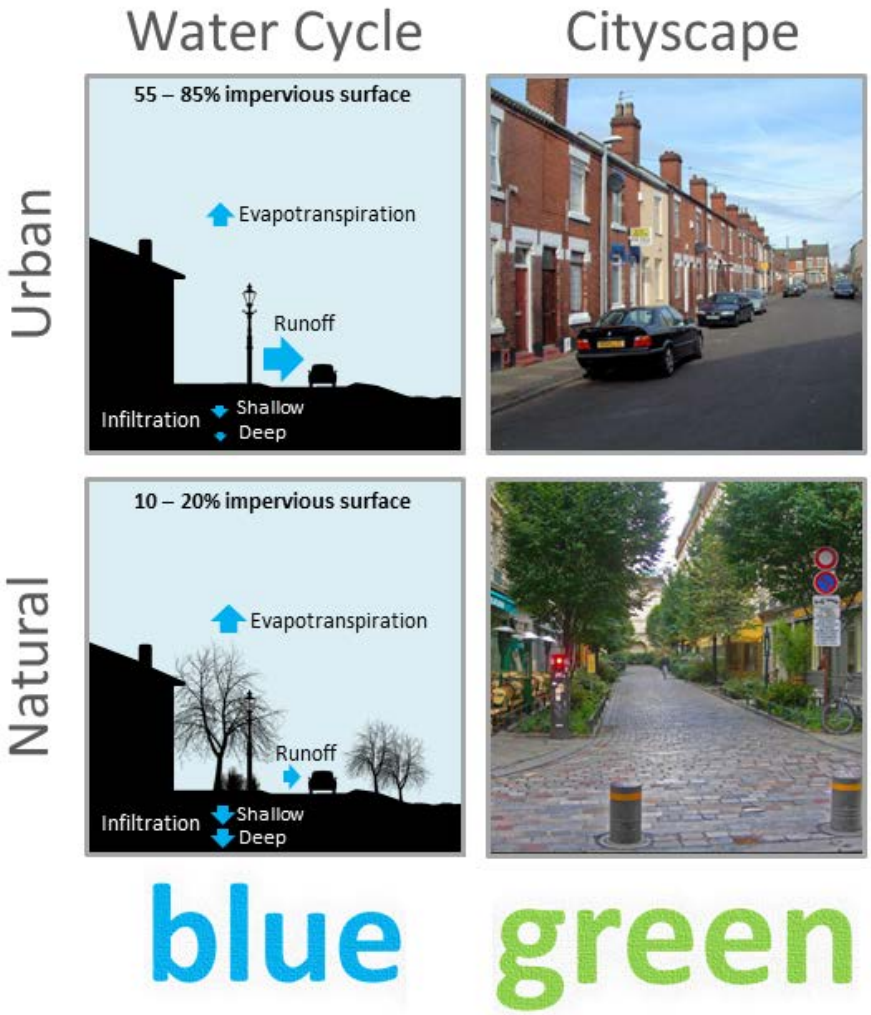
Traditional grey infrastructure



Blue-green infrastructure

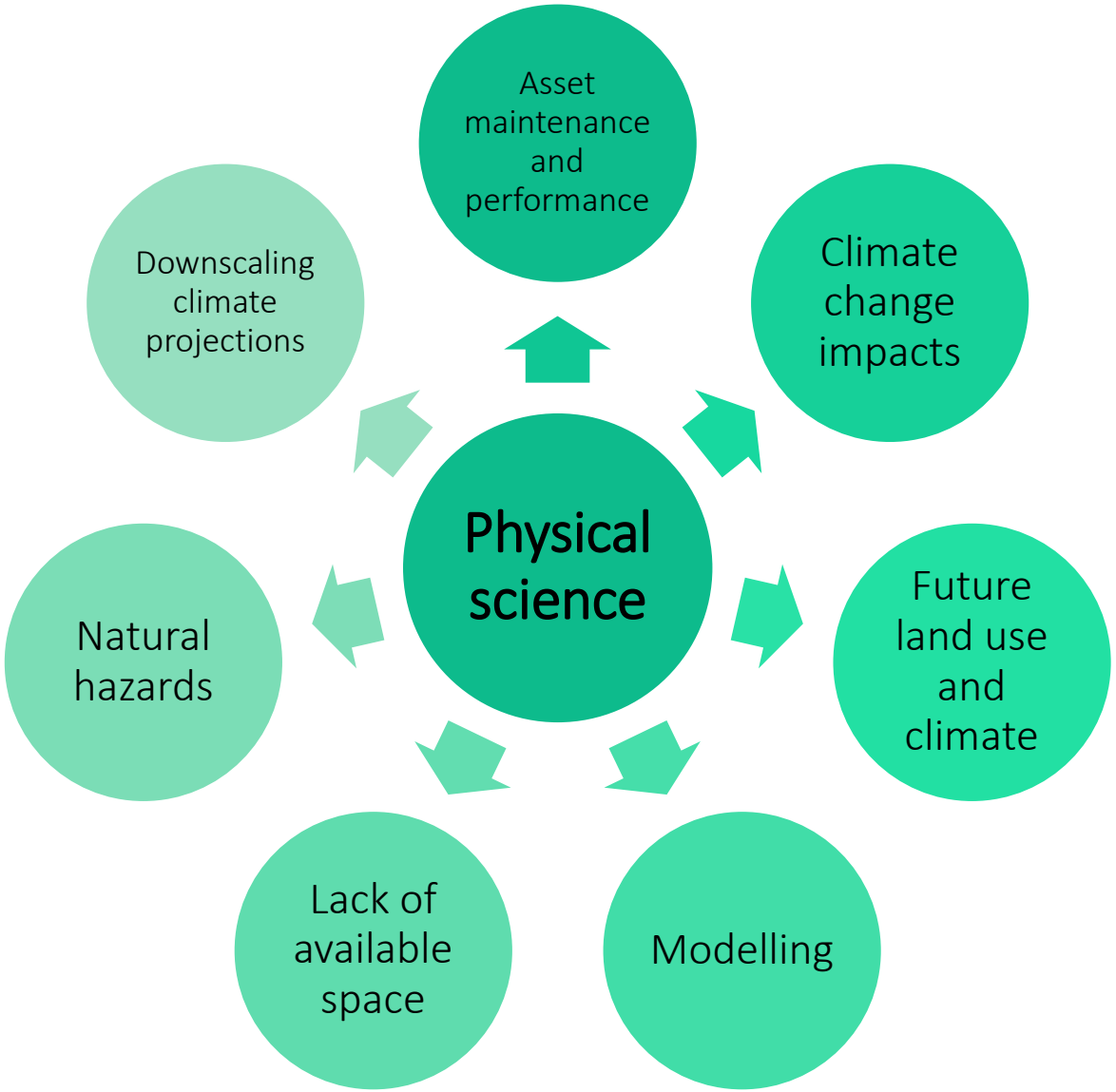


(Less obvious) blue-green infrastructure

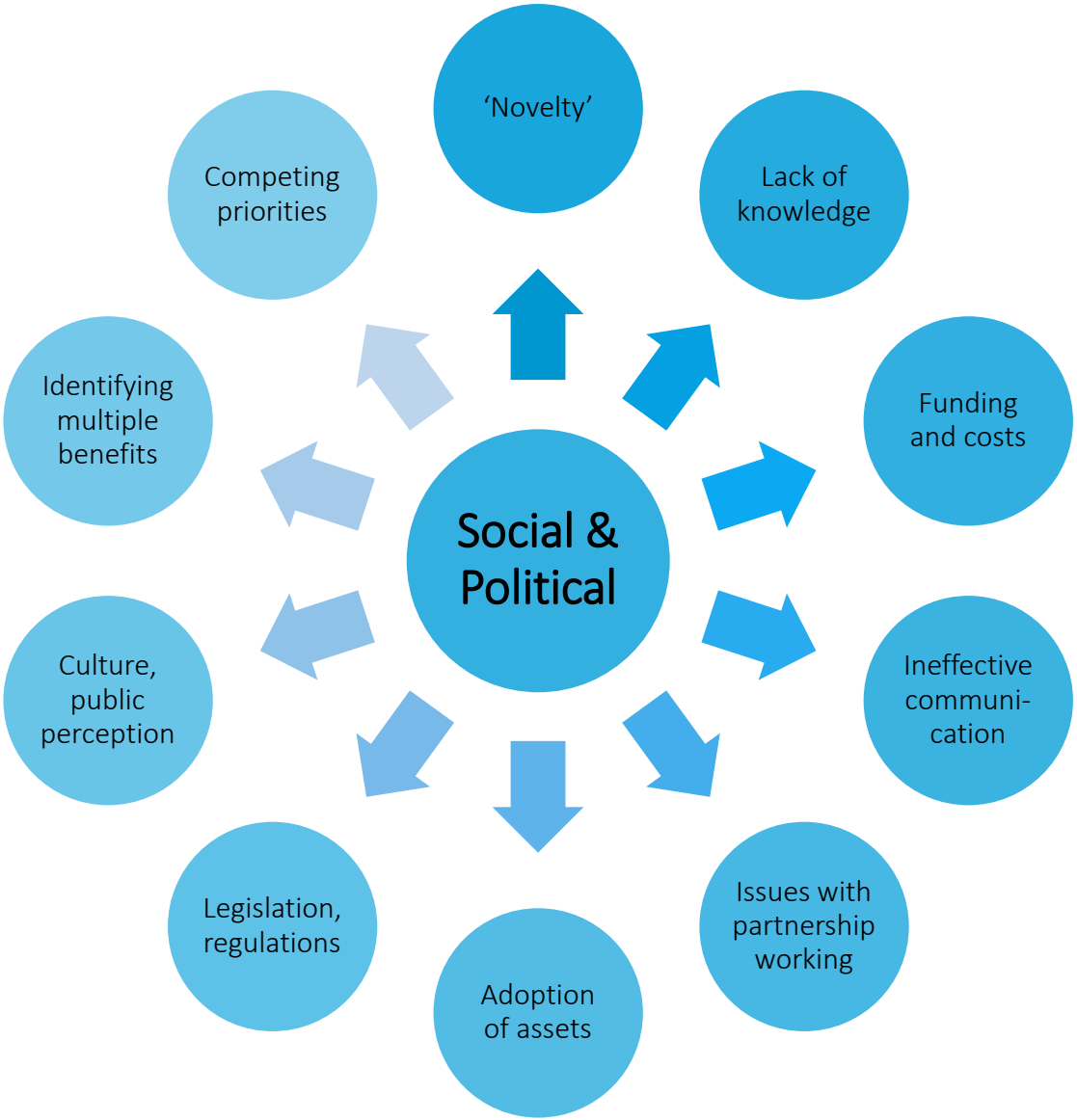


- Working with nature to manage water and deliver a range of **other benefits** to society, the economy and the environment
- Multi-functional landscape
- Blue-Green space connectivity

Barriers to Blue-Green infrastructure

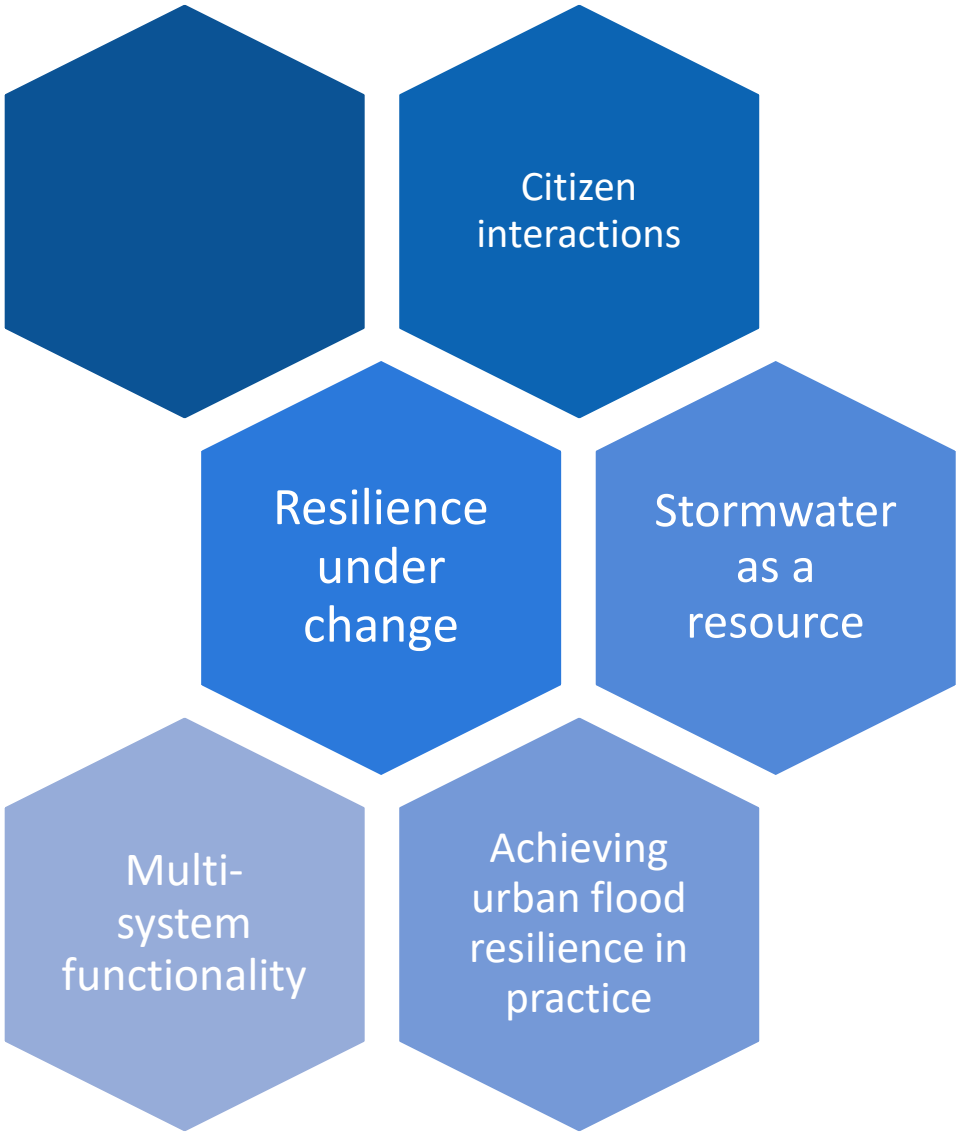


Barriers to Blue-Green infrastructure

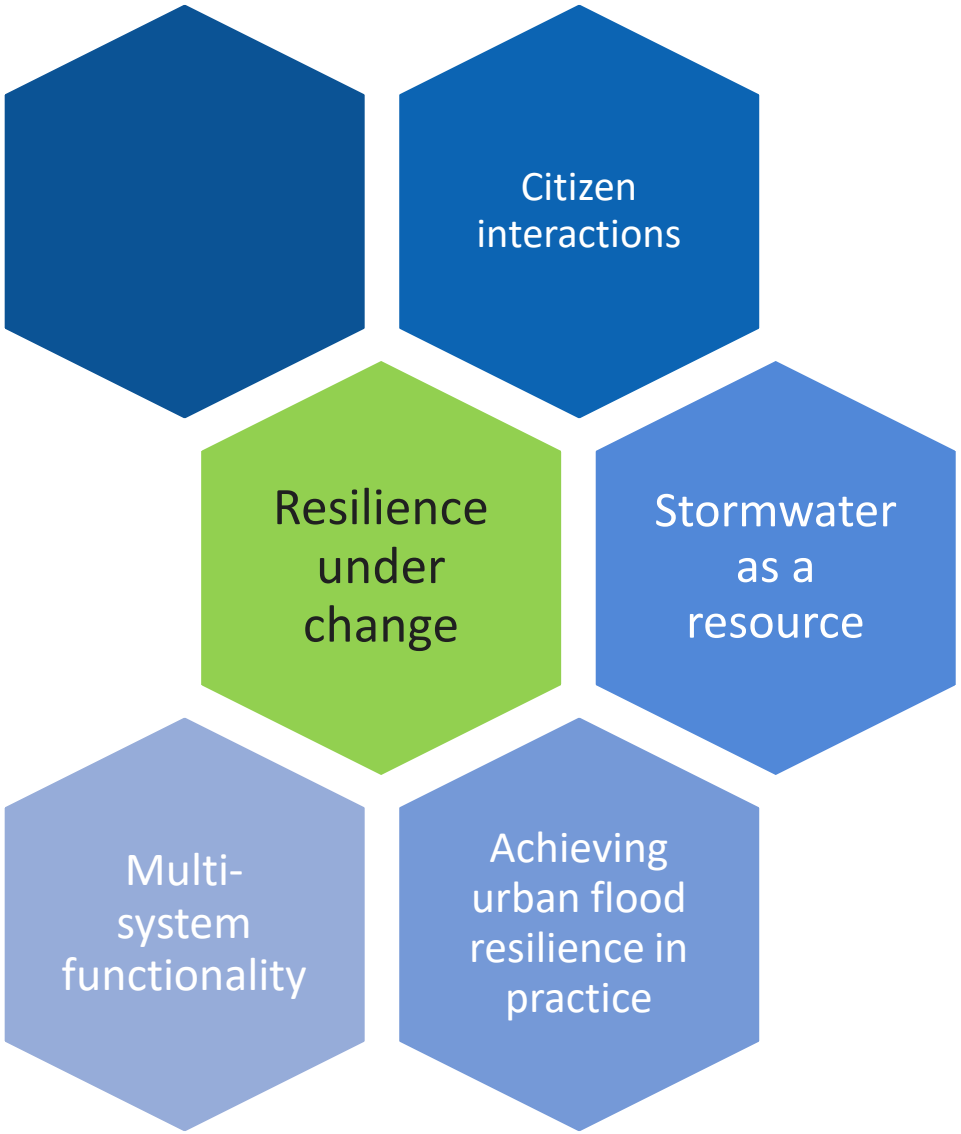


“Enabling the co-ordinated planning, design and operation of closely coupled urban water systems necessary to achieve transformative change in urban flood risk and water management.”

Project Structure

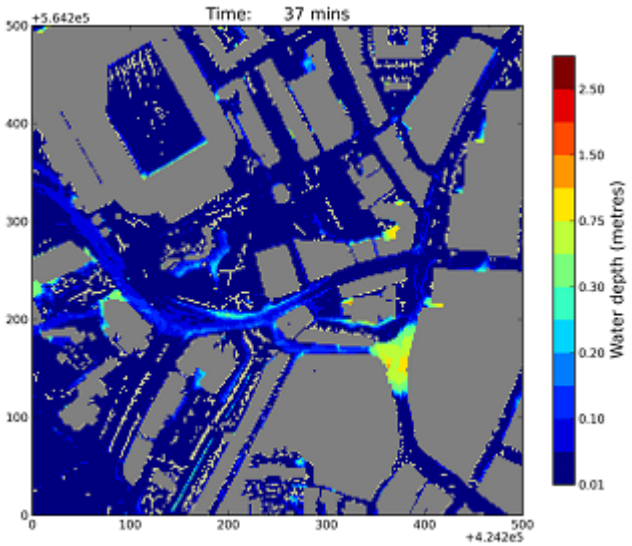


WP1


Citizen interactions
Resilience under change
Stormwater as a resource
Multi-system functionality
Achieving urban flood resilience in practice

WP1: Resilience under change

- **Aim:** To investigate the optimisation of blue-green and grey infrastructure system performance under future scenarios for climate and socio-economic change.

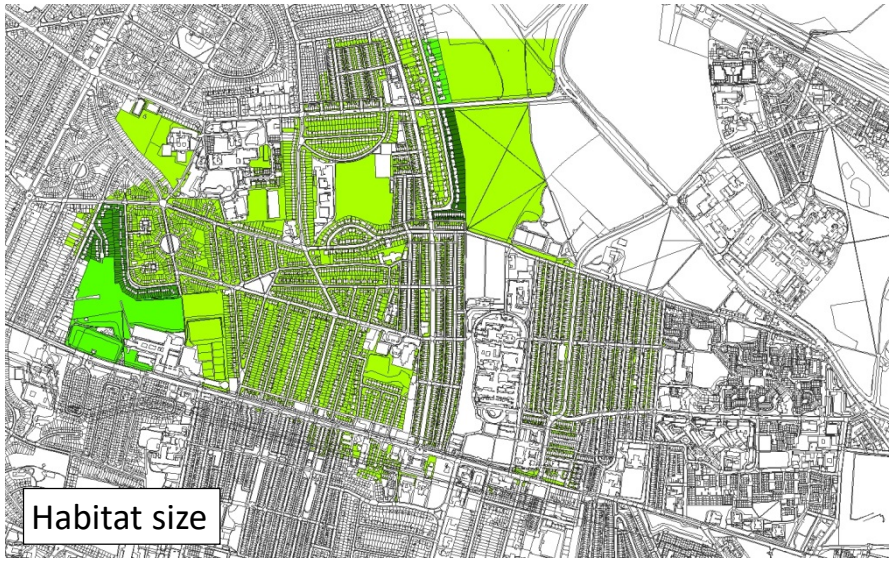


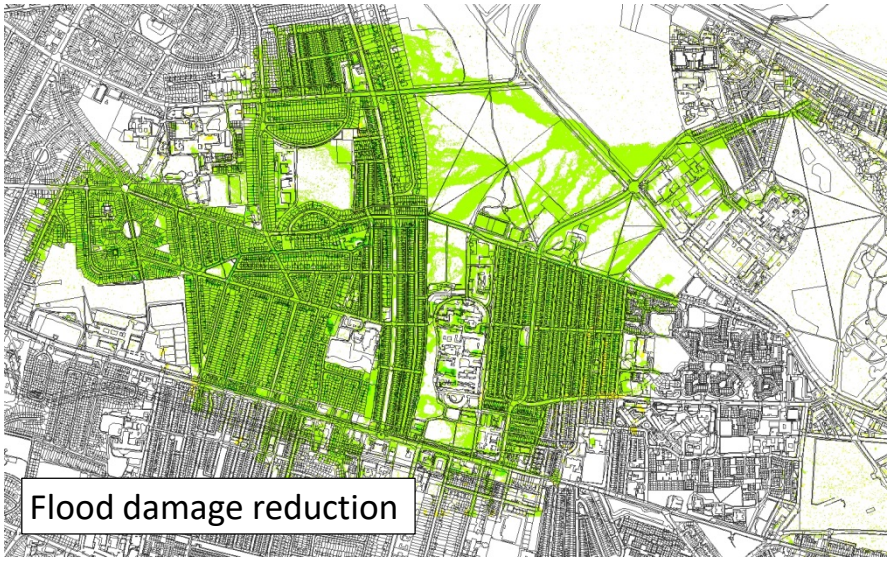
WP1: Resilience under change

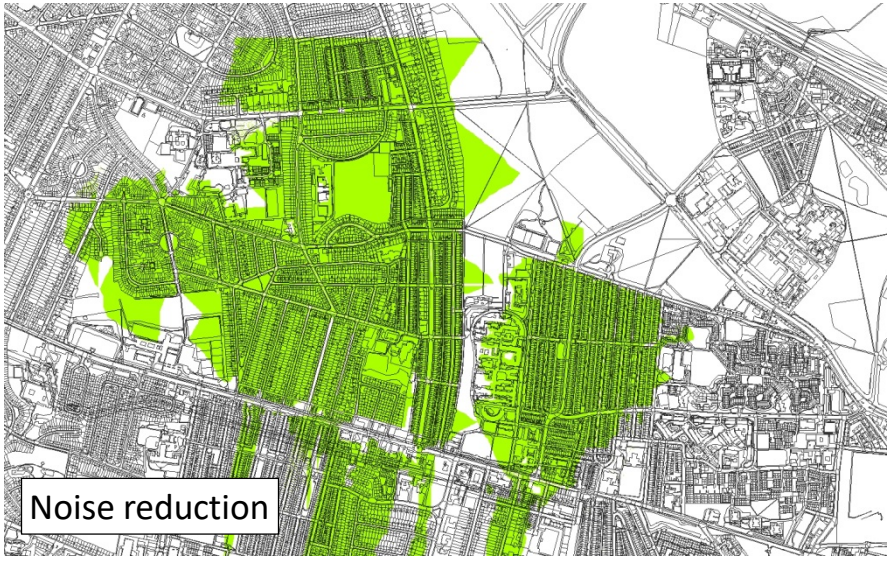
ArcGIS toolkit for multiple benefit evaluation

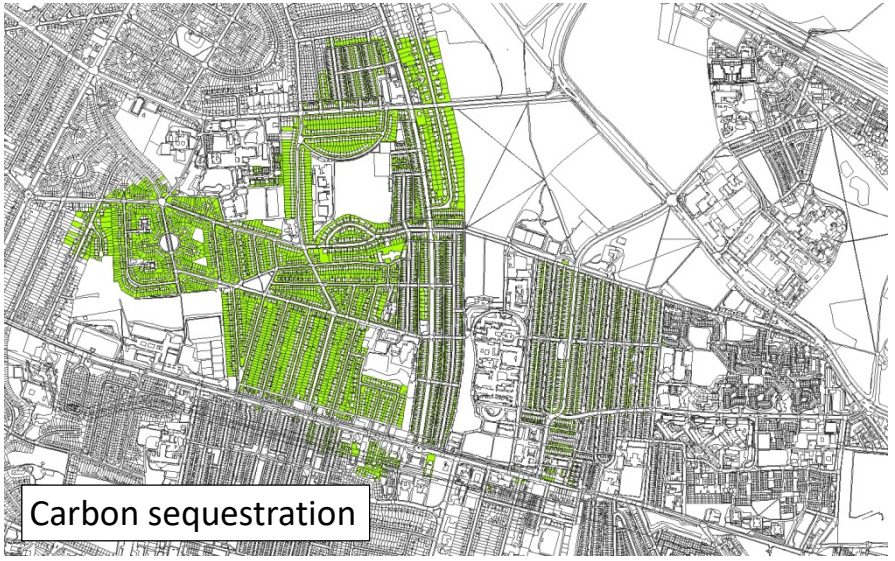
- Air pollution
- Access to greenspace
- Carbon sequestration
- Noise
- Habitat connectivity
- Flood

Individual benefits of permeable paving and urban greening









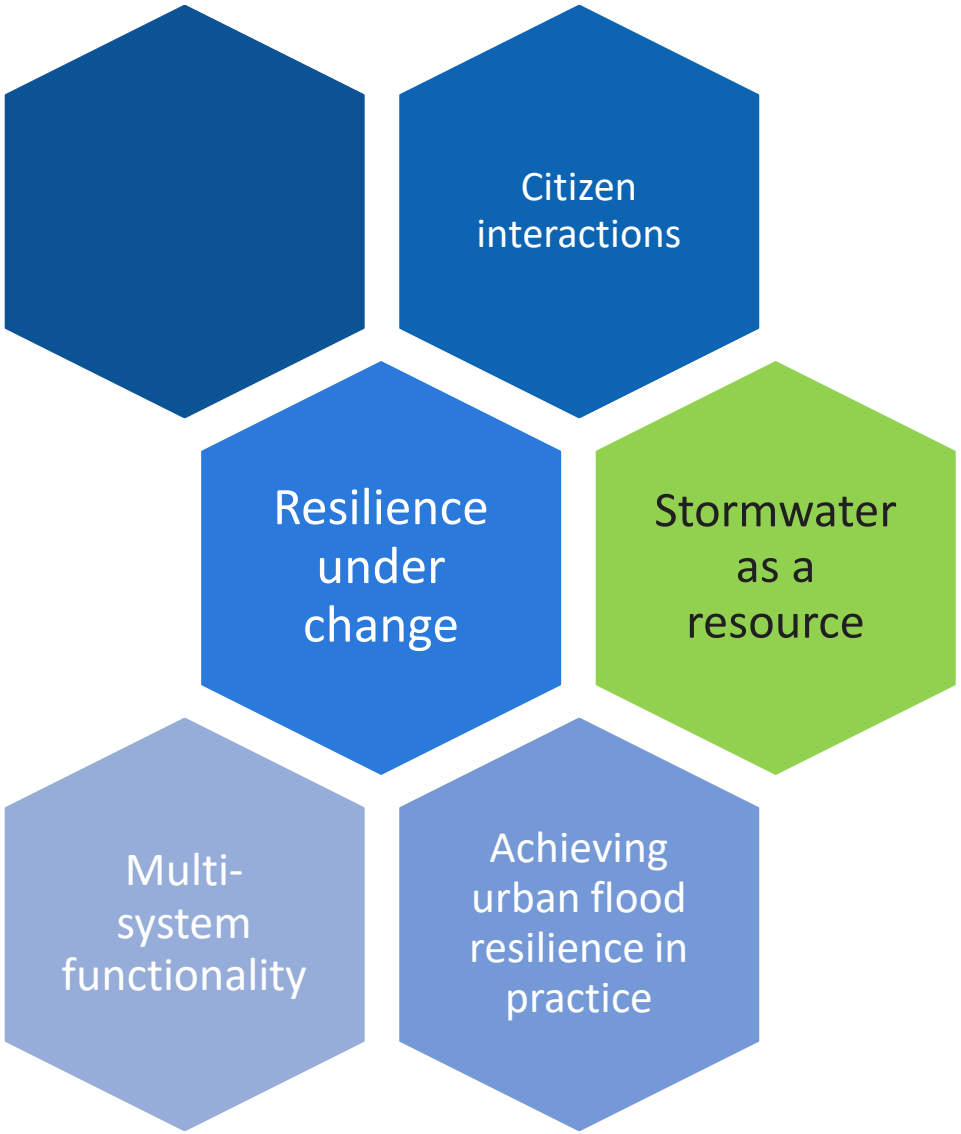
WP1: Modelling novel blue-green solutions

St James' Boulevard, Newcastle

RP= 50 years, 60 mins

Dimensions of swale:
Width = 2m
Depth < 1m

WP2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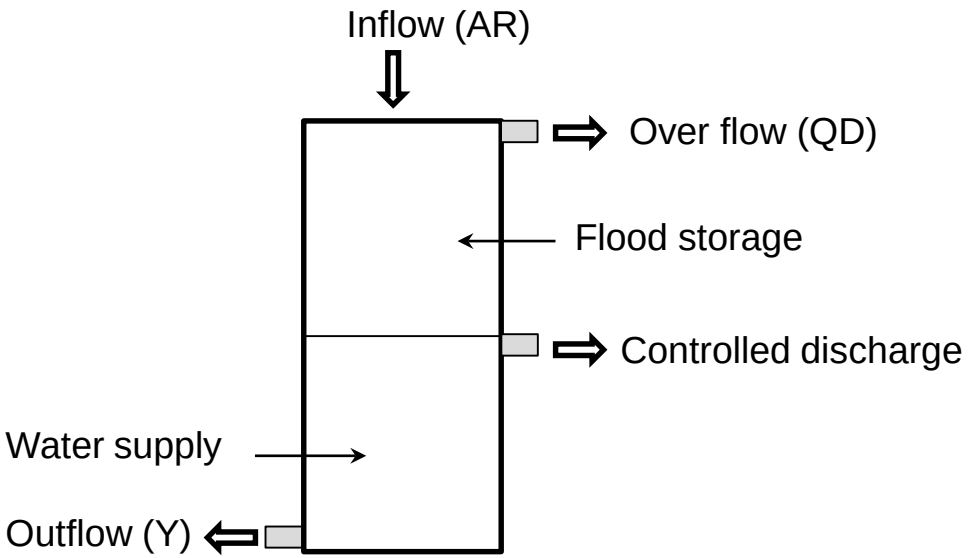
WP2: Stormwater as a resource

- **Aim:** To explore the potential for non-potable uses of water, including irrigation, groundwater recharge, micro-hydropower, recreation and ecosystem service provision.

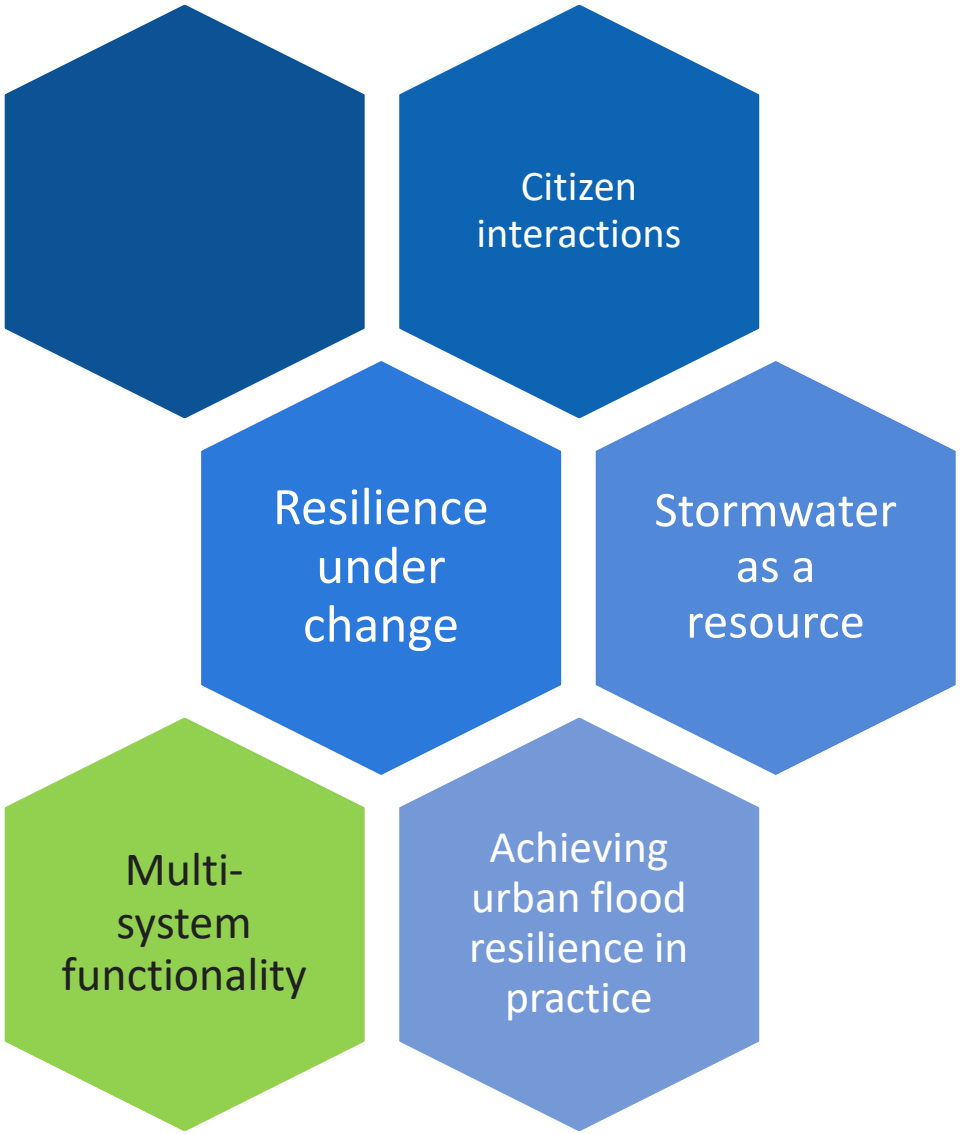
Water supply	Nature
Energy	Storage

WP2: Rainwater harvesting

- Three stages:
  1. Estimation of RWH system size
  2. Simulation using different rainfall datasets
  3. Performance evaluation (non-potable supply + stormwater management)



WP3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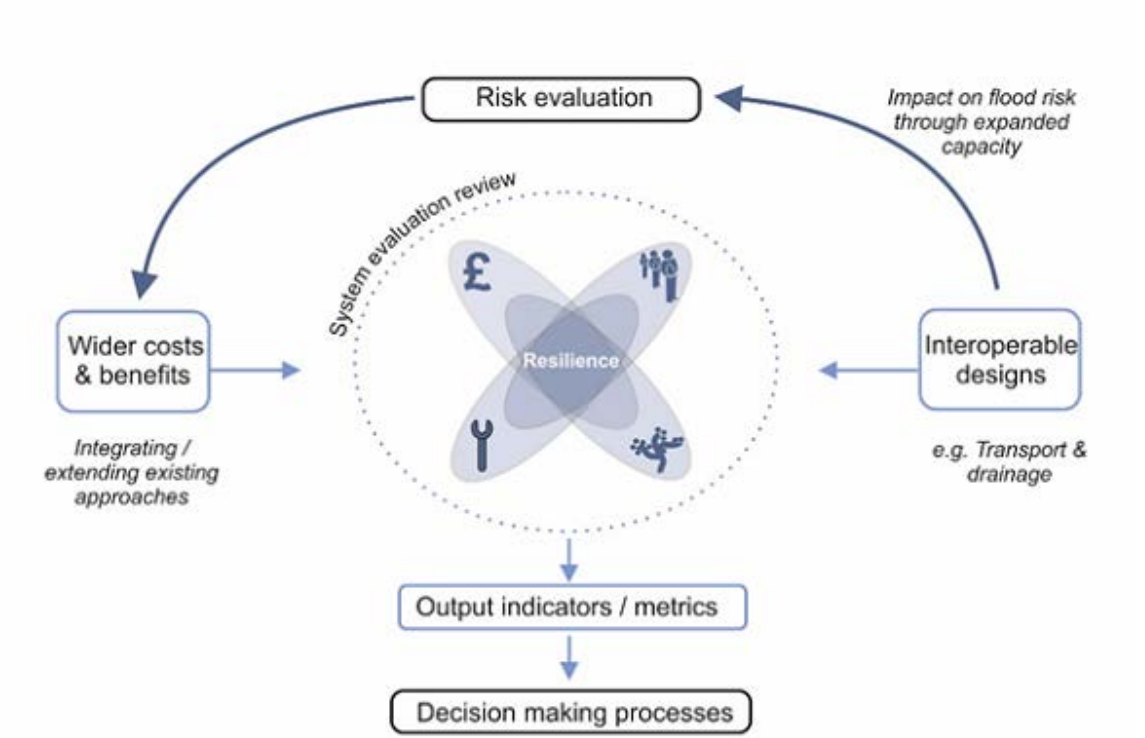
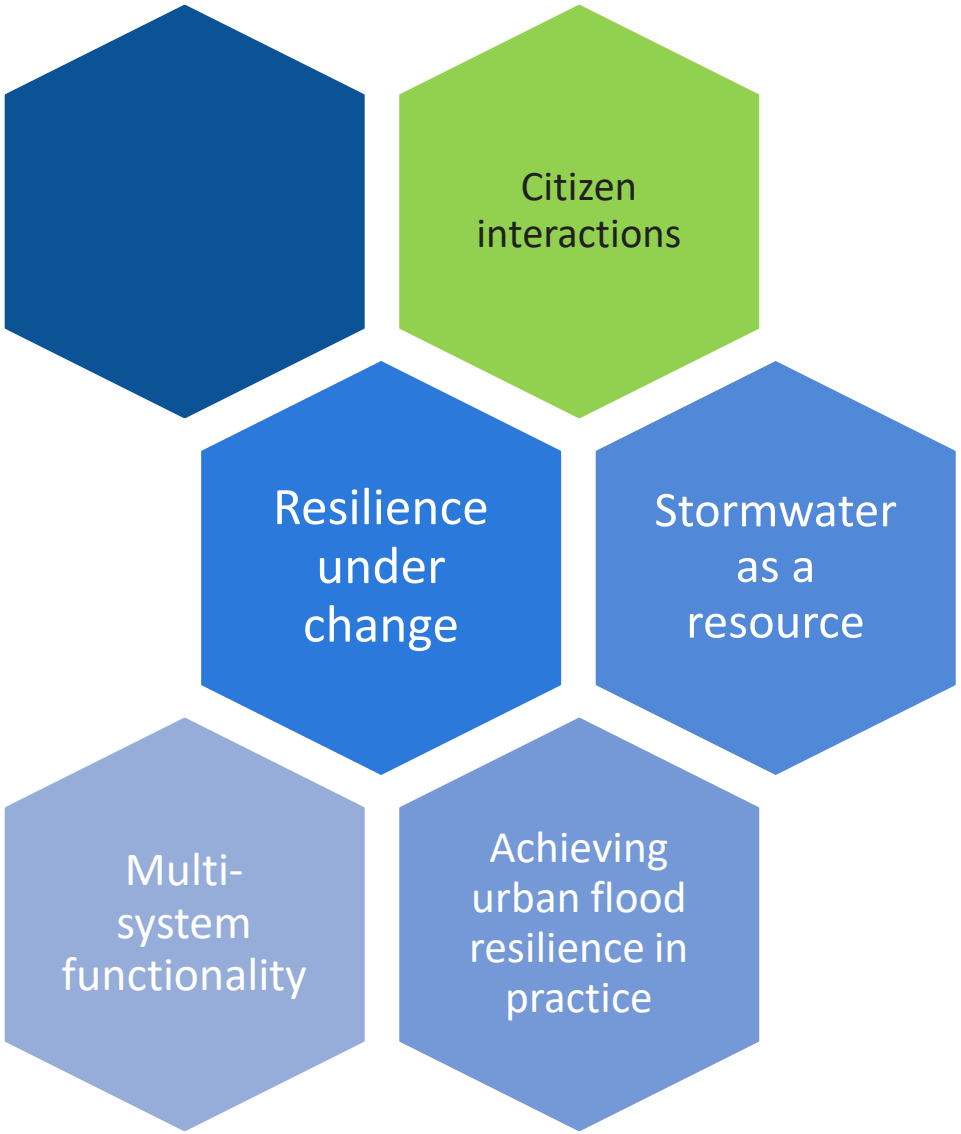
WP3: Multi-system functionality

- **Aim:** To model how blue-green infrastructure integrates with existing assets and systems, that collectively promote capacity and reduce flood risk.



WP4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WP4: What went before

- Local people are the local experts - with useful knowledge
- People value blue-green assets - if they understand them
- They will help maintain the Blue-Green assets they value
- But they need to feel *ownership* to make solutions work
- They must be engaged prior to and throughout implementation

Green street (SuDS) features in Portland, Oregon

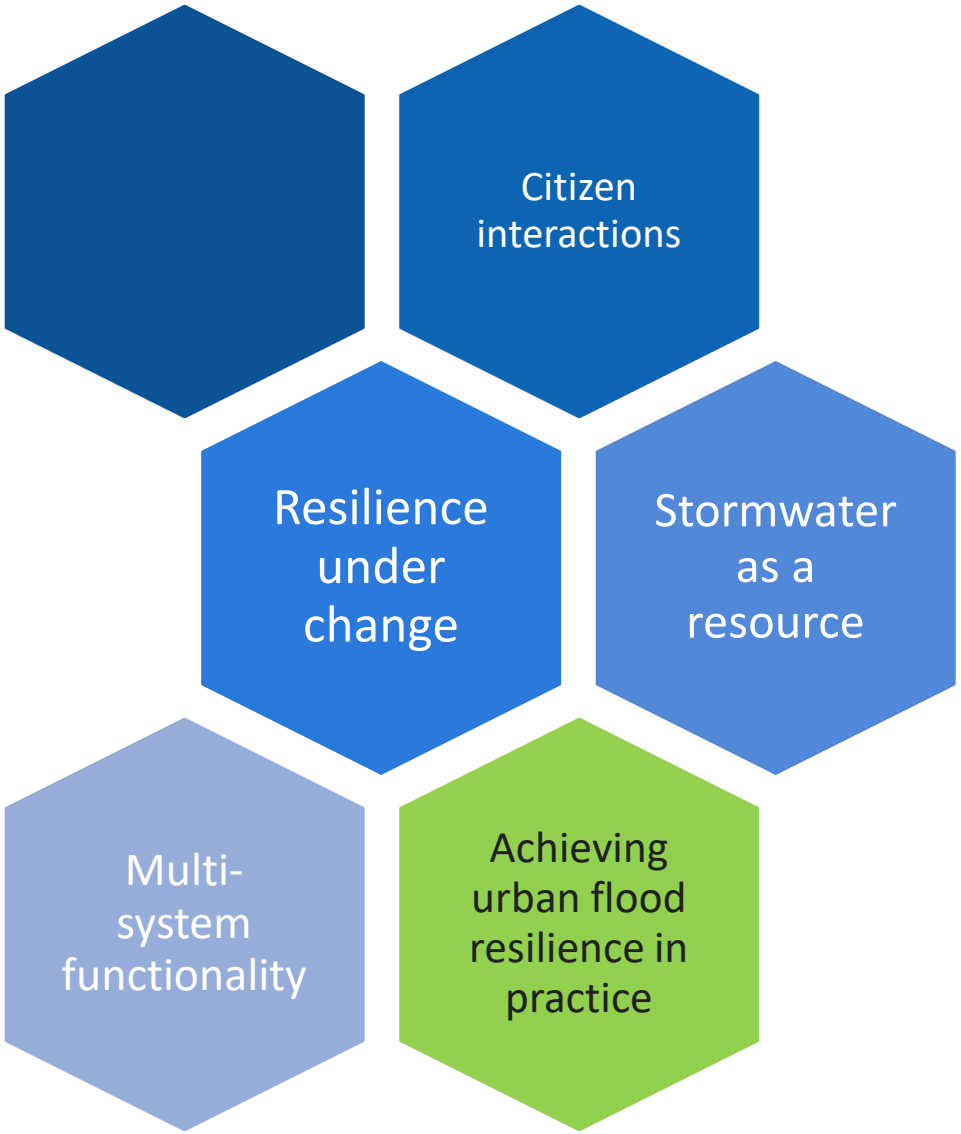
WP4: Citizen interactions with blue-green features

Aim: To co-develop new mechanisms for engaging with communities, improve flood awareness and communicate the multiple benefits of blue-green infrastructure.

SuDS at Newcastle Great Park
Source: Emily O'Donnell

- Participatory action research
- On-line communication
- Community dialogue
- Online systems

WP5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Learning and action alliances (LAAs)

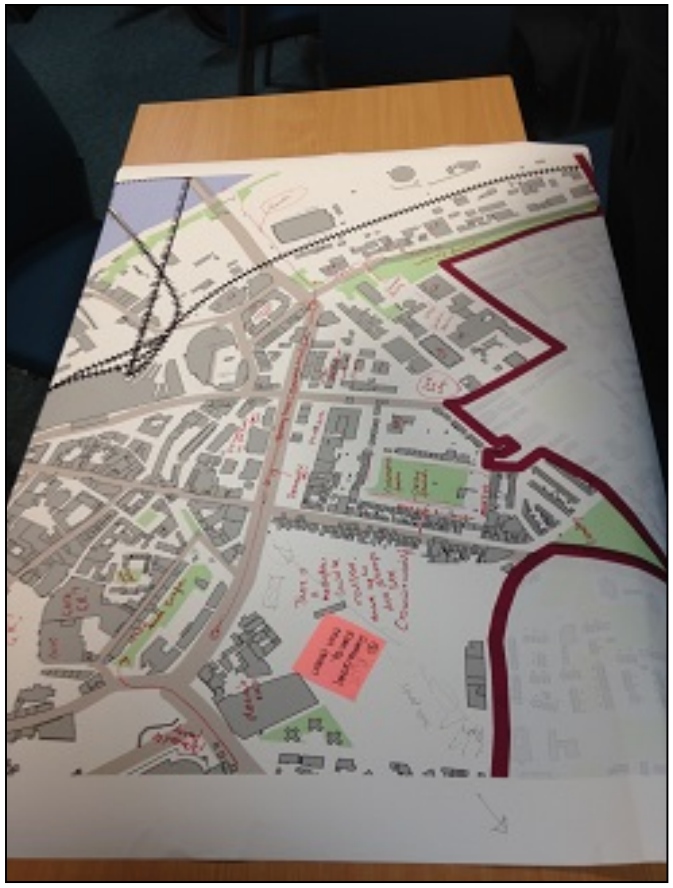
- An LAA is usually an **open arrangement** where participants create a **joint understanding** of a problem and its **possible solutions** based on rational criticism and coherence through **discussion**

- It facilitates the identification of **innovative ideas** for the solution of complex (wicked) problems **outside the constraints of existing formal institutional settings**

- Solutions or ideas are afterwards presented in formal inter-organisational **decision-making processes**

The Newcastle Learning and Action Alliance

‘Blue-Greening’ the urban core: a master-planning workshop



Newcastle
LAA

Newcastle helps lead the way in blue-green cities move to combat flood risk

15:30, 19 FEB 2016 | BY TONY HENDERSON

More water storage and greening spaces in Newcastle are the basis for the city conference pledge at the Life Science Centre

8 SHARES | COMMENTS

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Witherspoon Photography

Blue-Green Cities conference line up, left to right, Fula Ogunyoye, Haskoning DHV: David Wilkes, Arup: Marie Fallon, Environment Agency; Clare Rogers, Newcastle University; Richard Warneford, Northumbrian Water; Coun Ged Bell, Newcastle City Council

Blue and green could rival black and white as key colours in the Newcastle of the future.

Source:
Newcastle Chronicle
http://www.chroniclelive.co.uk/news/north-east-news/newcastle-helps-lead-way-blue-10914312

The Ebbsfleet Learning and Action Alliance

- Ebbsfleet provides a demonstration site to test and showcase the outcomes of the urban flood resilience project, with a strong focus on **new build applications.**

Ebbsfleet aerial view (left) and vision for a 'Garden City' (right). Source: EDC

Acknowledgement

The *Urban Flood Resilience Research Consortium* is supported by:

EPSRC Pioneering research and skills
The River Restoration Centre
Ebbsfleet Development Corporation
Newcastle City Council
ciria
Environment Agency
UKWIR
Department for Infrastructure An Roinn Bonneagair
Public Health England
water industry forum
sniffer knowledge brokers for a resilient Scotland
RTPI mediation of space · making of place
NWG living water
ARUP
ATKINS
HR Wallingford Working with water
Royal HaskoningDHV Enhancing Society Together
MWH
SWECO

Thank you

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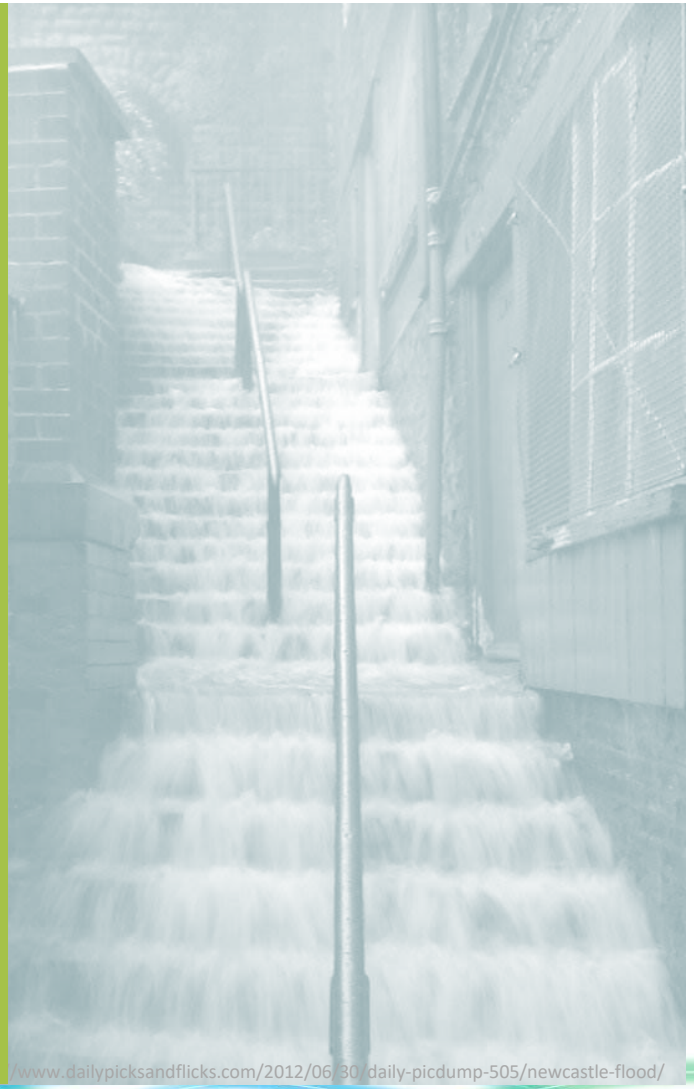

/www.dailypicksandflicks.com/2012/06/30/daily-picdump-505/newcastle-flood/

Interoperability and resilient urban water systems

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urban flood resilience

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Urban Flood Resilience in an Uncertain Future

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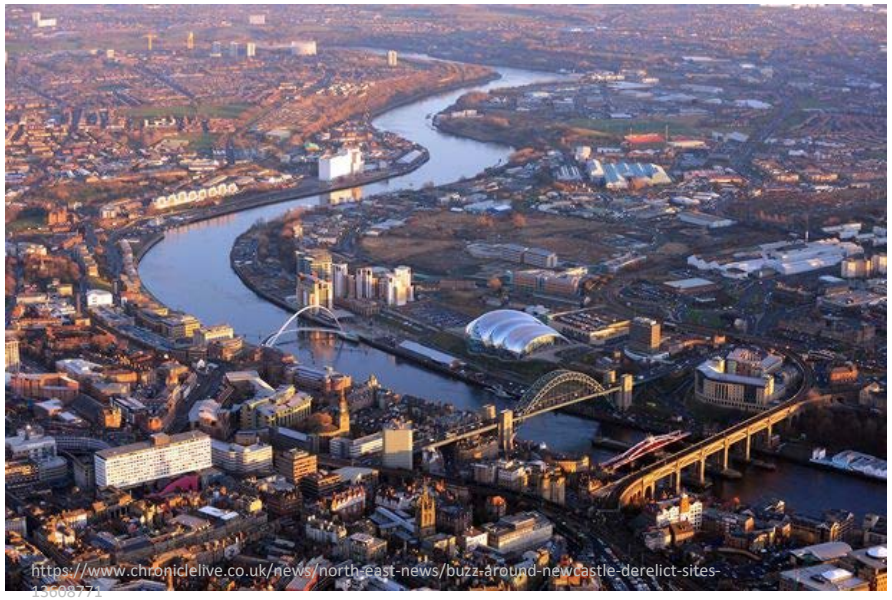
Project case study sites

Newcastle



https://www.chroniclelive.co.uk/news/north-east-news/buzz-around-newcastle-derelict-sites-13668771

Ebbsfleet Garden City

http://aktax.co.uk/accountants-kent/ebbsfleet-garden-city-to-be-revealed-in-september/

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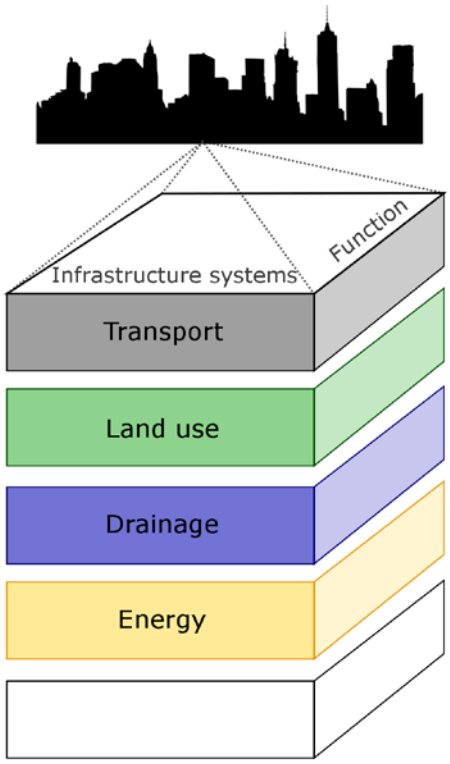
BUT: city = a system of systems



- Interdependencies
- Competing demands
- Limited space

⇒ Need for a holistic approach

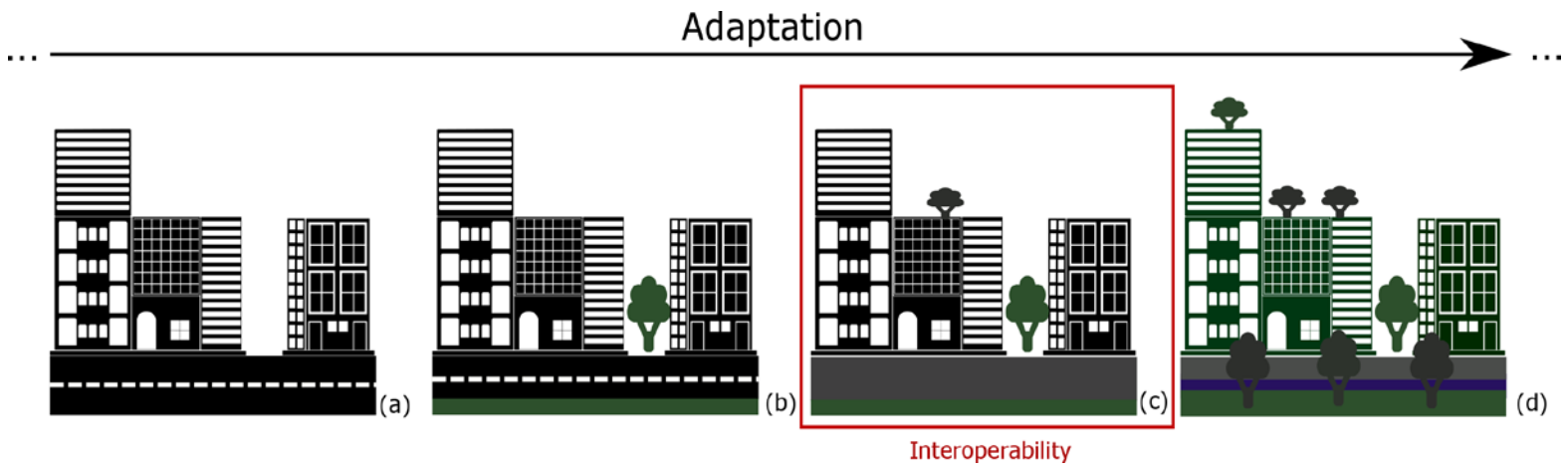
⇒ **This is NOT a new idea**

⇒ **BUT: HOW?**

Interoperability

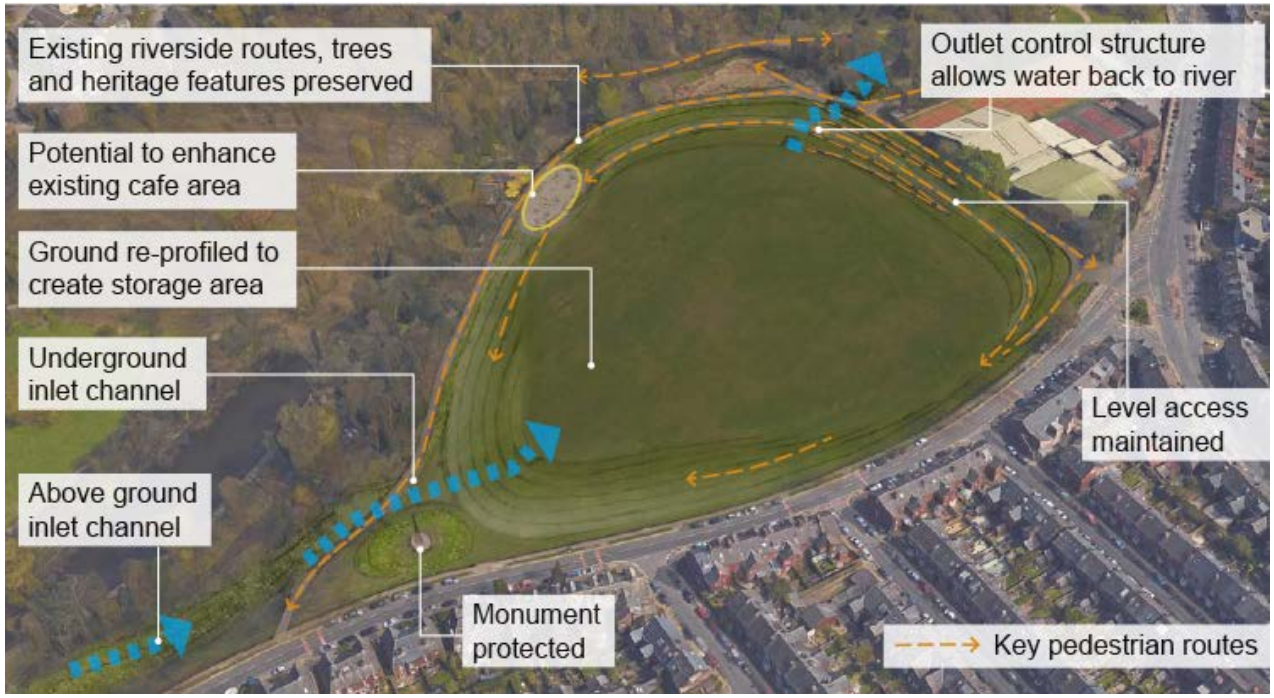
"The ability of any water management system to redirect water and make use of other system(s) to maintain or enhance its performance function during exceedance events"

⇒ ***Actively managing connections***


Adaptation
(a)
(b)
(c)
(d)
Interoperability

Example 1: Drainage & transport system

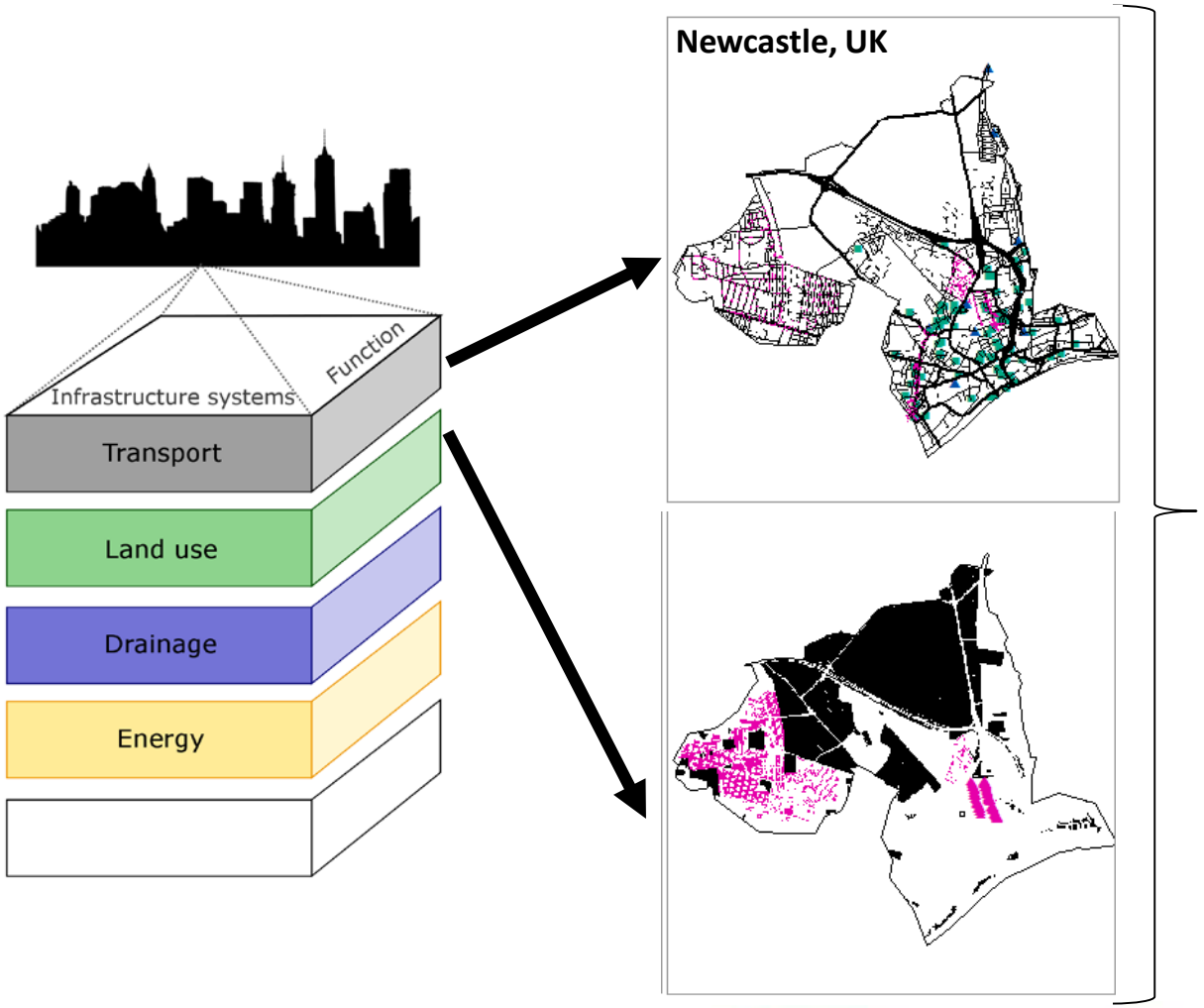
Example 2: Drainage & land use system



So, we have options.

BUT

can we approach interoperability in a more systematic way?

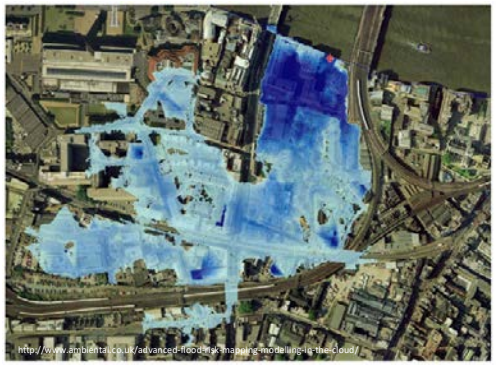


Site per site?

OR

Systematic?

Integrated



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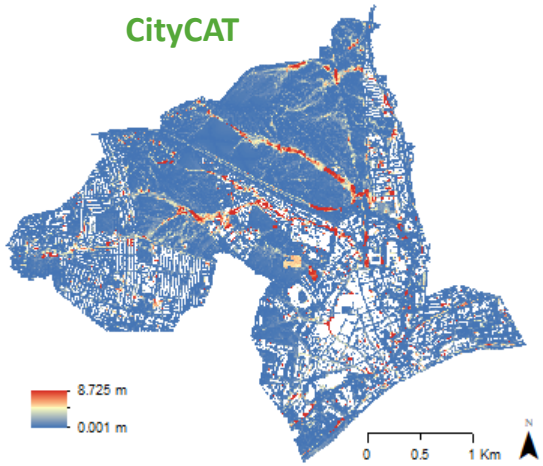
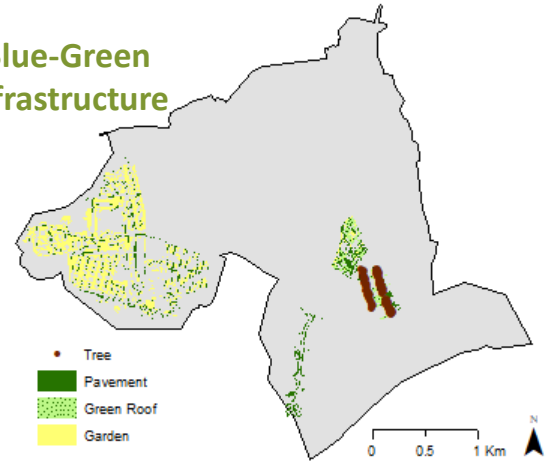
Newcastle, UK

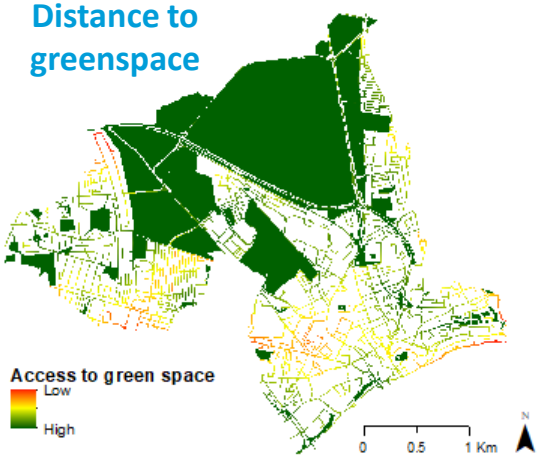
CityCAT



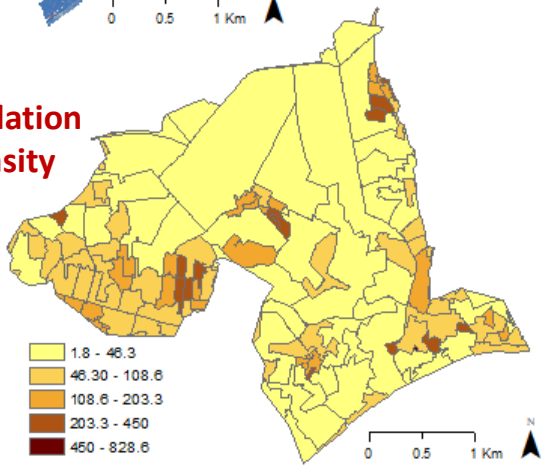
Blue-Green infrastructure



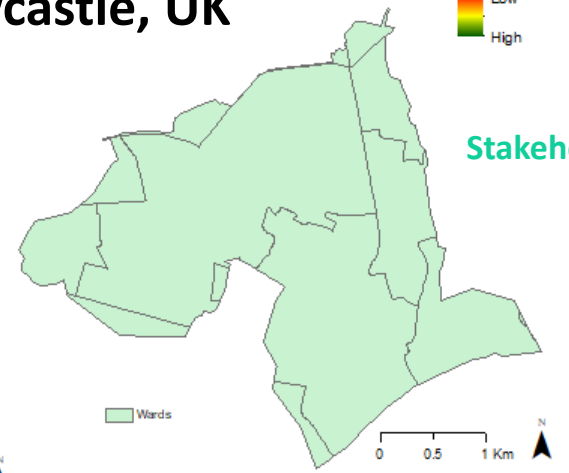
Distance to greenspace



Population density



Stakeholders



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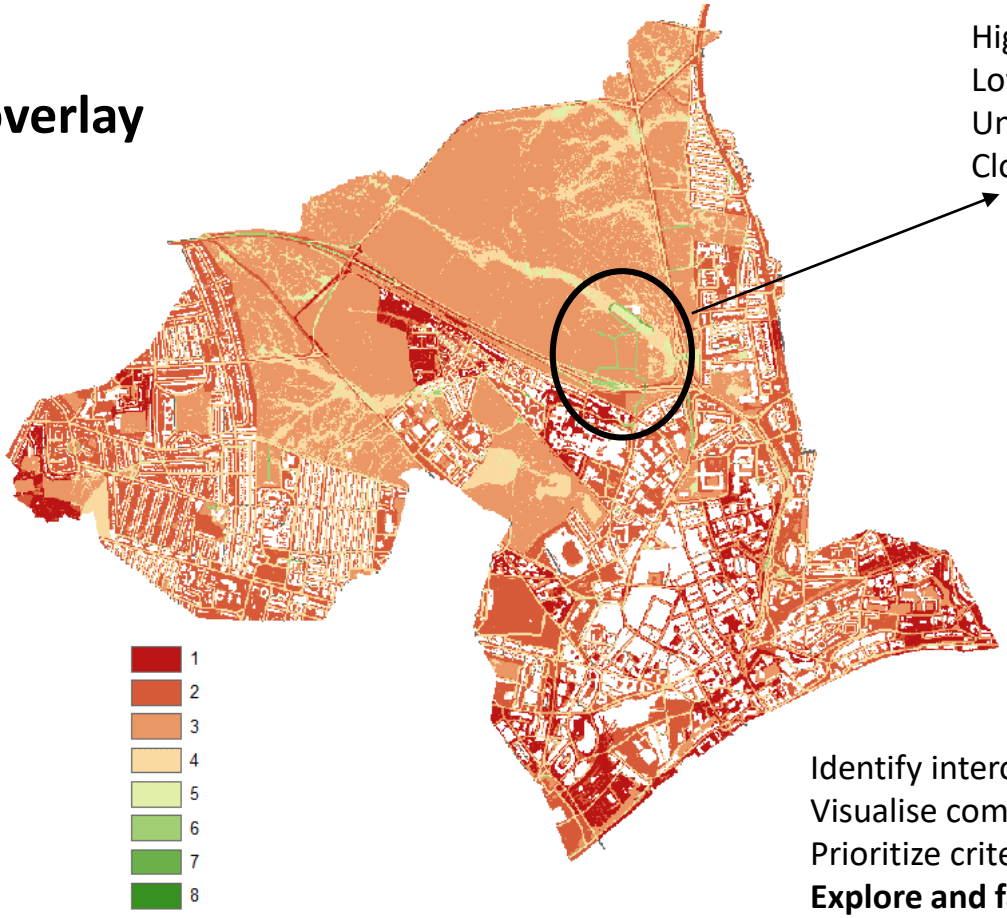
Weighted overlay



High flood risk
Low population density
Unimportant road
Close to green space

Identify interoperability “hotspots”
Visualise complexity
Prioritize criteria
Explore and facilitate system approach

Many thanks for your attention!

Please do get in touch if you have any comments or questions

Email: k.vercruysse@leeds.ac.uk
Website: http://www.urbanfloodresilience.ac.uk/