

Synchronicity: Multiple Benefits from Green Infrastructure (Looking at SUDS from both sides now) apologies to Joni Mitchell, Judy Collins and Pink Floyd

Richard Ashley

Thanks to:
Berry Gersonius
Jeroen Rijke
Brian D'Arcy,
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Paul Shaffer,
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Louise Walker
Gaye McKissock
Neil McLean



The
University
Of
Sheffield.



UNESCO-IHE
Institute for Water Education



Halcrow
A CH2M HILL COMPANY



MWH

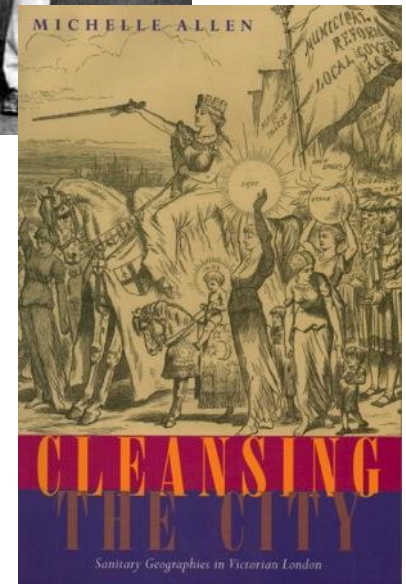
BUILDING A BETTER WORLD



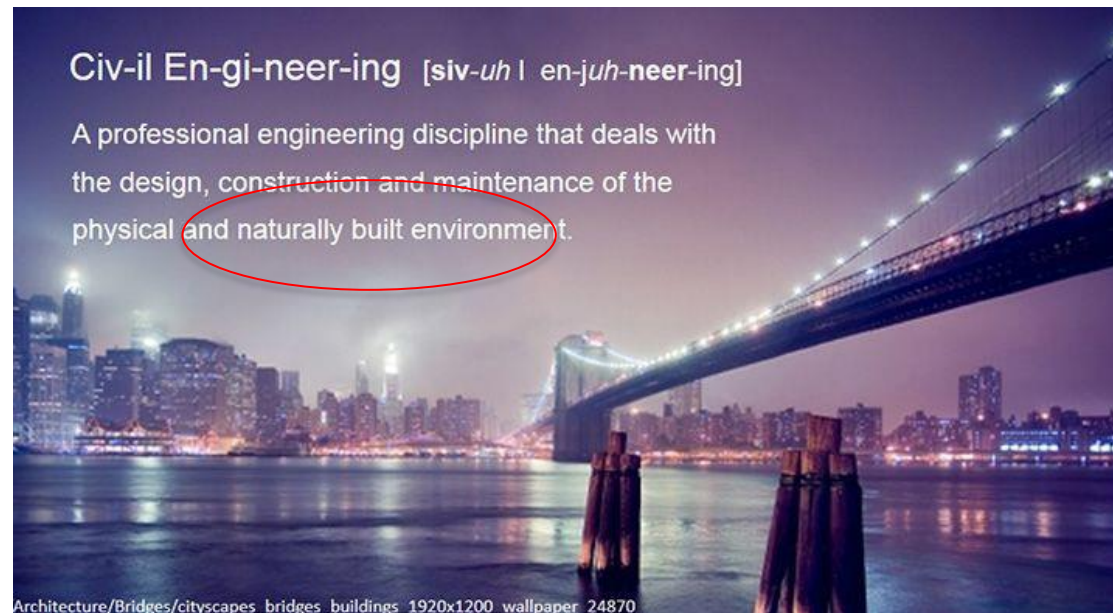
CRC for
Water Sensitive Cities

The great sanitation revolution was clearly needed and brought about by (visionary) engineers...

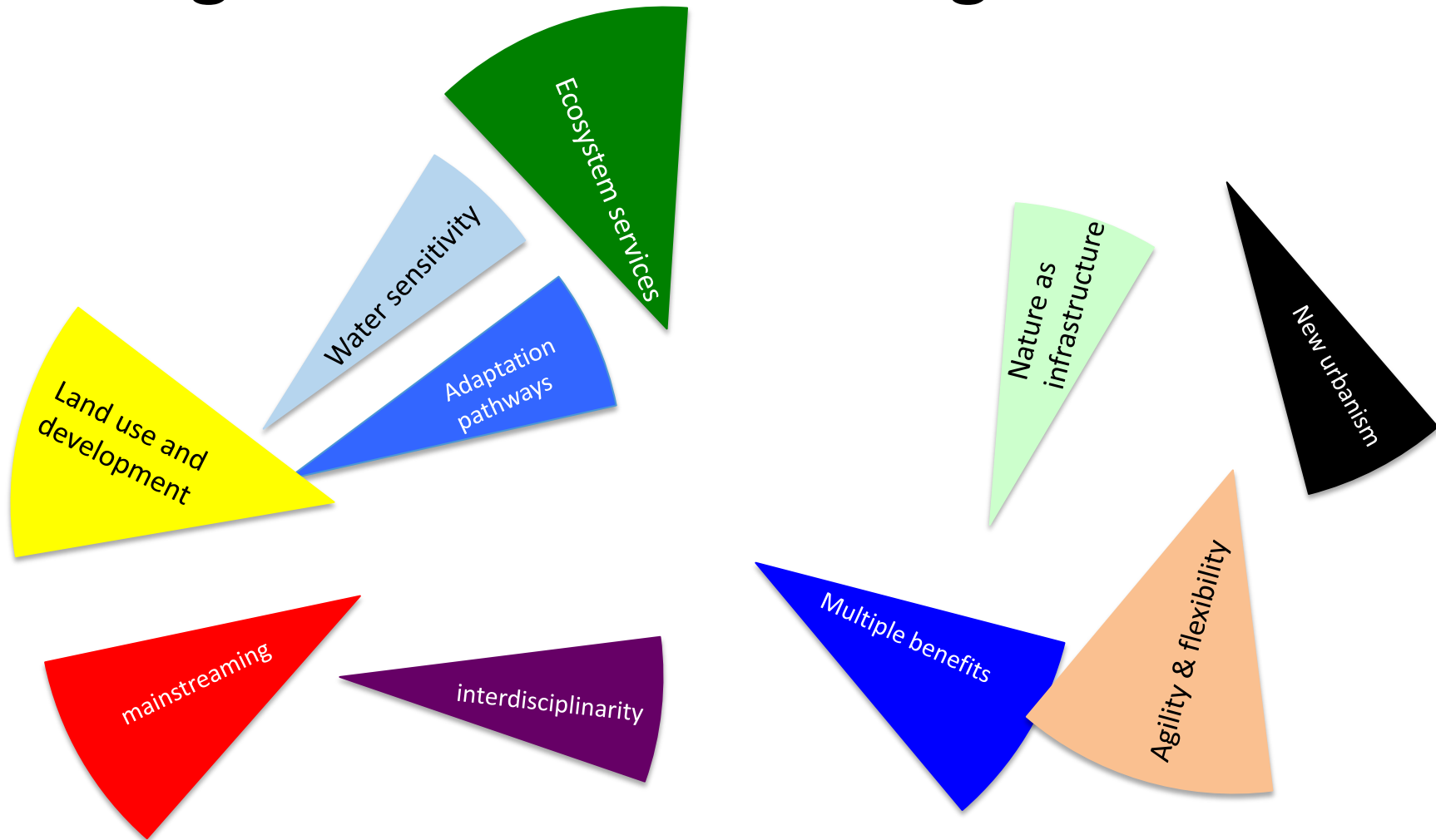
- In the 1840s, Edwin Chadwick said engineers were:
“hyperexpensive, unscientific and dangerous” (Hamlin, 1992)
- Nonetheless we moved to centralised drainage systems to defeat the wastewater enemy
- Of course this criticism cannot be true today



And we knew (know) best...



It's a great time to be doing this stuff



The story of 'sustainable' drainage systems

- They were with us *before* centralised sewers were
- Surface water was hazardous and needed to be out of sight (and out of mind)
 - Land use planning could safely ignore this water as it was out of the way



Flooding! danger

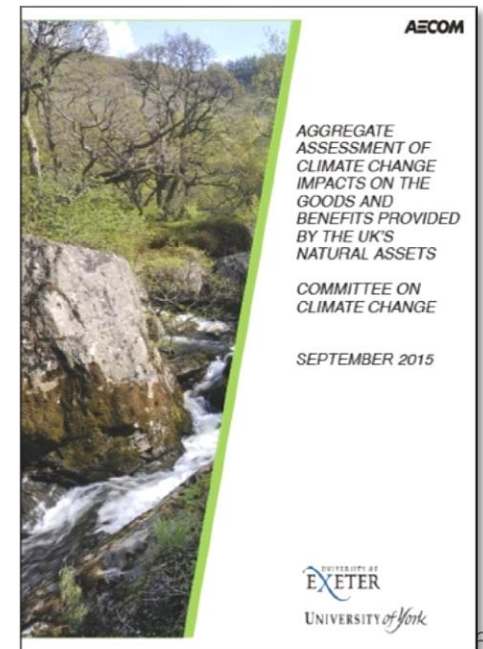
Do not drink the water

Do not enter the water

At the time piped systems were *the sustainable option*

What's changed (if anything?)

- People
- Resources
- World changing (fast)
- Legacy infrastructure



Effects of climate on combined sewer overflows (AECOM, 2015)

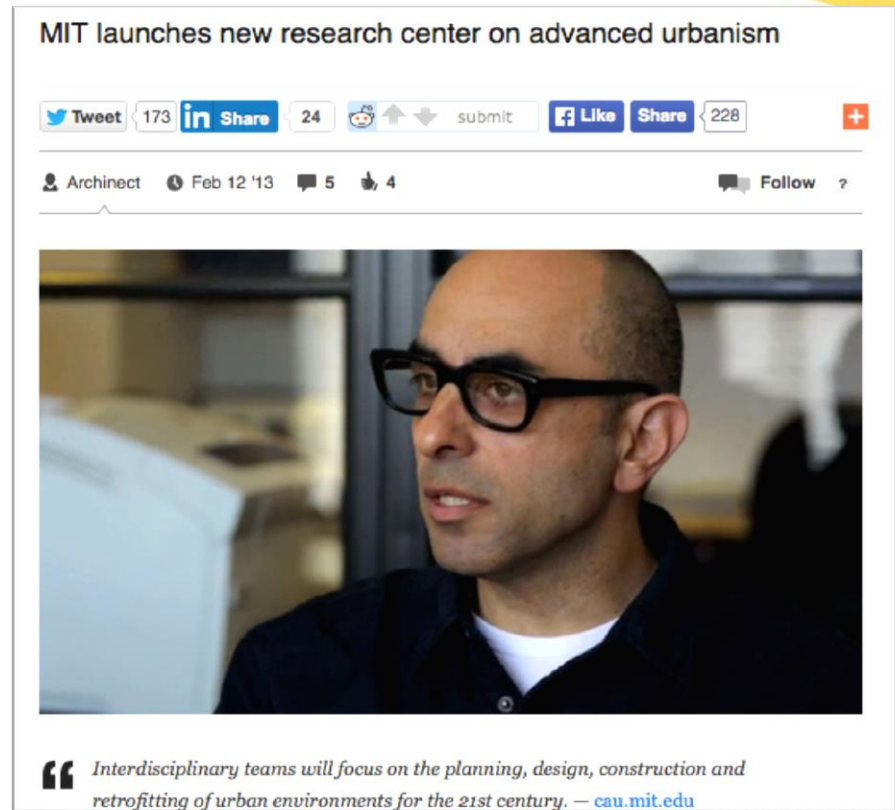
“Future increases in rainfall intensity would increase the risk of CSO discharges, particularly in urban areas without SUDs installed. Nutrient enrichment could interact with temperature related productivity increases to cause more algal blooms.”

Direction of impact	Climate variable		Mechanism(s)	Relative Importance
	Present trend (confidence)	Future trend (confidence)		
Exacerbating	Winter precipitation		Increased discharge and runoff to sewage systems	++
	↑ (Low)	↑ (Low)		
	Summer precipitation		Reduced flushing and dilution	+
	↓ (Low)	↓ (Medium)		
	Rainfall intensity		Flashier, more frequent runoff	++
	↑ (Low)	↑ (Medium)		
	Temperature		Reduced assimilative capacity of environment	+
	↑ (High)	↑ (High)		

Lack of regard for new wave planning and urbanism

Planning urban areas is now much more complex:

“Already, the world is becoming predominantly urban. However, the dominant form of urban living will be very similar to our older suburban regions. This places substantial pressure on established suburban models; the dominant model of urban development copied worldwide, to set a better example of sustainability.”



A term first coined in Scotland

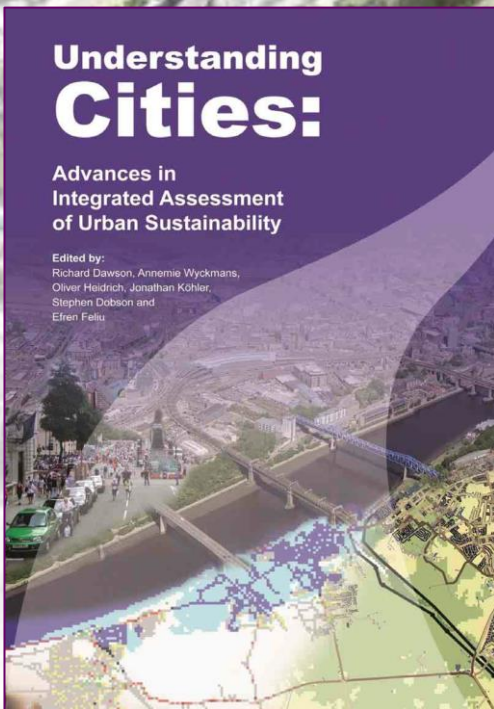
The
conundrum
of
'sustainable
drainage
systems'
(SuDS,
SUDS)



We 'sort-of' know what these are

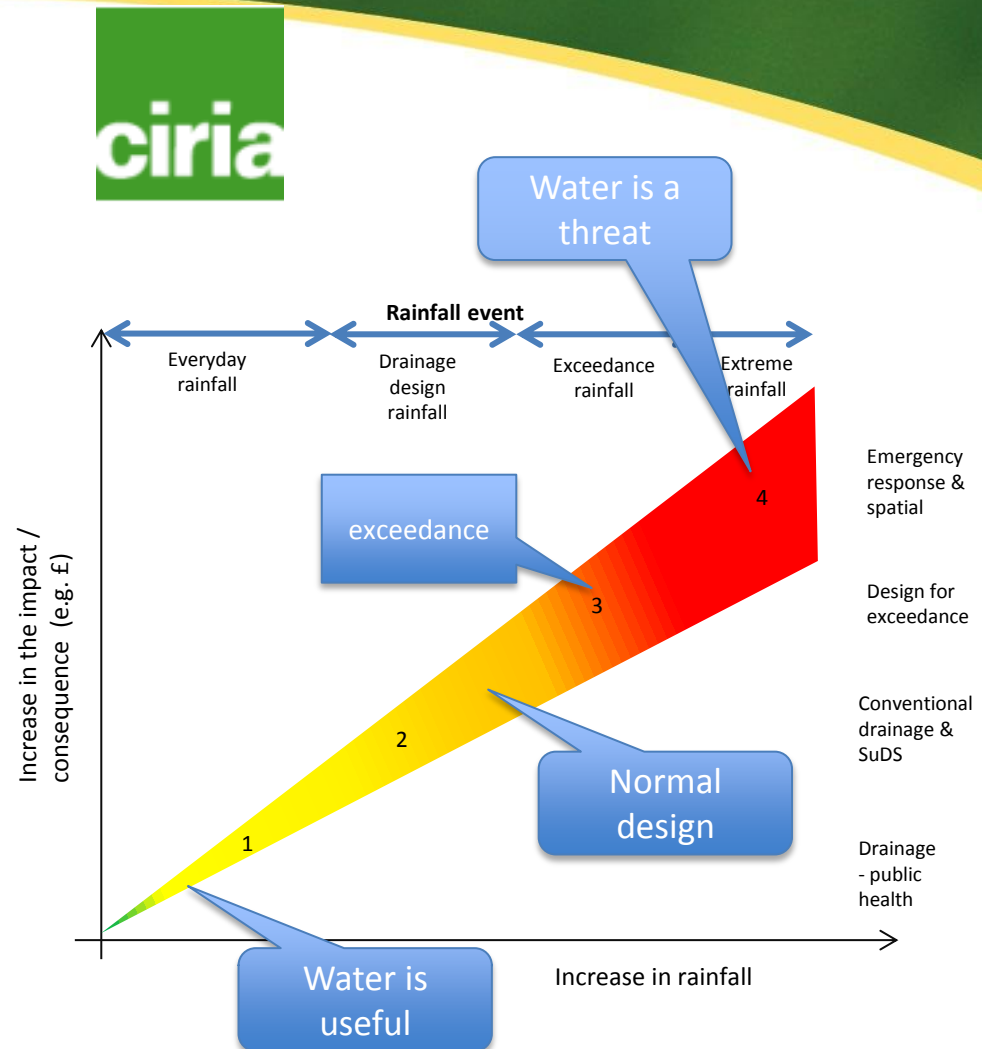
SUDS in a landscape

- No space is useless
- Context is all important
- GI *and* grey infrastructure needed together
- Nature in the city
- Making it business as usual is a complex process

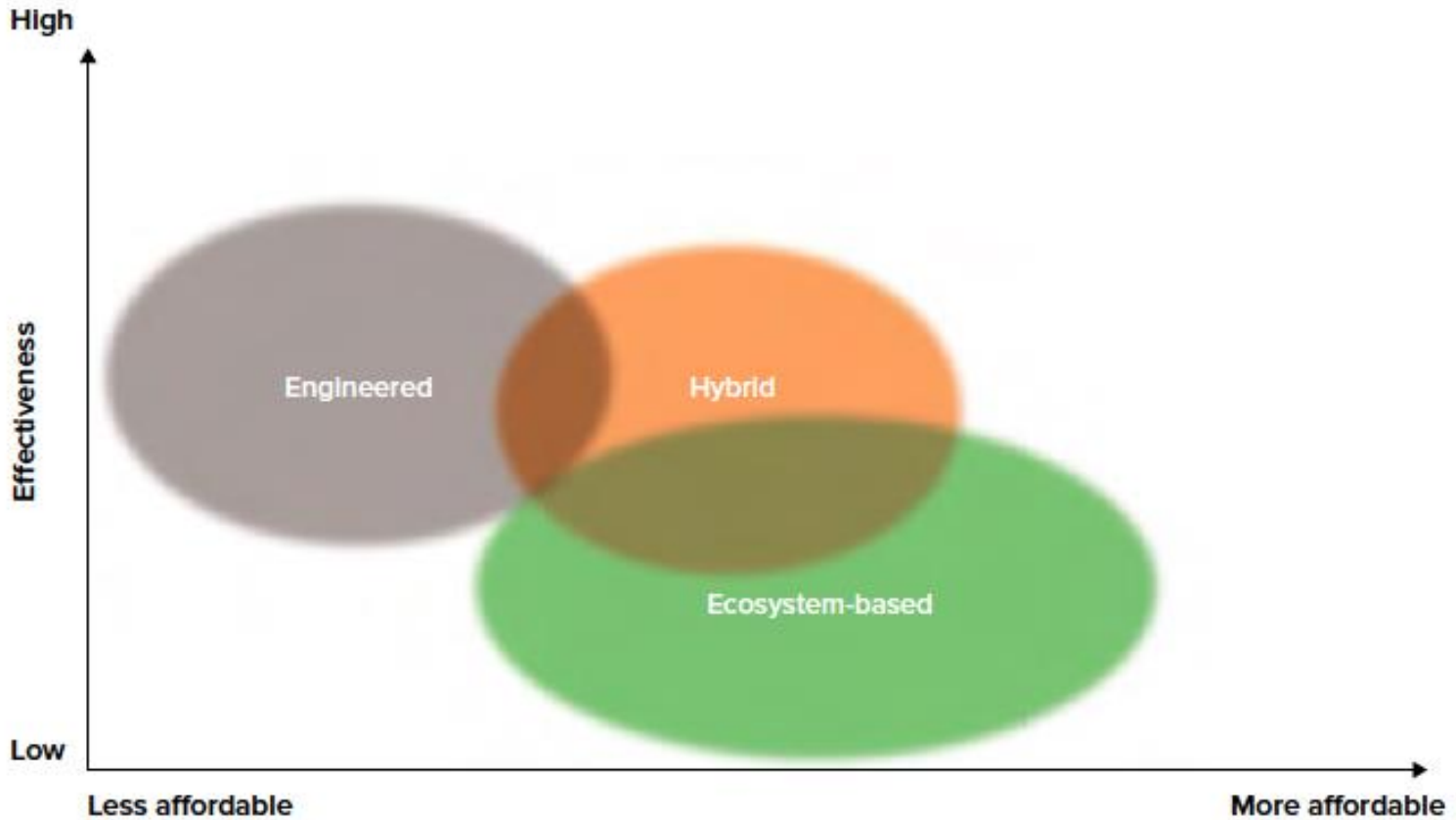


A significant time....

- CIRIA SuDS Manual revised this year
- CIRIA multiple benefits of SuDS tool: BeST – now
- CIRIA retrofitting SuDS guide 2012
- CIRIA Designing for exceedance 2014
- All ready for commencement of Sch.3 of Flood & Water Management Act



Infrastructure effectiveness and affordability in relation to extreme hazards (Royal Society 2014)



What we did (& what some are doing now)

- If you follow the rules
 - Regulations
 - Codes of practice
 - Design standards
 - ‘What computer says’
- Then you are safe
 - Otherwise it’s too risky
 - Professional indemnity means we need to use tried and tested options




“Technical Guidance to the National Planning Policy Framework advise an uplift on rainfall intensities of 30% when designing to 2085 and beyond”

Devolved administrations

It's happening in Scotland & Wales



Disintegrated UK



The Scottish Government
Riaghaltas na h-Alba

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Business, Industry & Energy

Water Industry

- Who does what?
- Water Charges
- Improving Services
- Statutes, Governance & Constitution
- Publications
- Complaints
- Scotland the Hydro Nation**
- Water Resources (Scotland) Act
- Useful Links

Scotland the Hydro Nation

Hydro Nation

The Scottish Government is committed to making Scotland a Hydro Nation. Our water resource is significant and in a world demanding more food and water, there is good reason to nurture it for long term sustainable use.

Water is of fundamental importance for Scotland's economy, health, social wellbeing and environment. All businesses rely on the water environment in some way or another and water plays a prominent role in the success of many sectors of the economy. Some are of strategic importance to Scotland's economy, such as tourism, food and drinks manufacturing and renewable energy generation.

The hydro-economy provides huge opportunities for Scotland which we as a Hydro Nation will maximise the benefits to the Scottish economy to stewardship of Scotland's abundant water resources.

The Scottish Government will support the development of Scotland's hydro this brings. There are 3 main aspects of the Hydro Nation agenda:

- Utilising Scottish expertise to maximise the economic benefit of our ecological context by reducing energy use, improving efficiency and
- Raising our international profile through recognition of Scotland as a and governance – The first Hydro Nation.





Gardd Law

Beth yw gardd law?

Mae gardd law yn ardal a blannwyd i ddal a glanhau dŵr glaw sy'n glawio ar y ffordd

Dal a glanhau dŵr glaw



1. Gall dŵr coed eluso dŵr glaw a'i neysio mewn rwyd i'r gwlad

2. Mae dŵr glaw sy'n glawio ar y ffordd yn ielfo i ardd dŵr lle caiff ei lanhau

3. Mae thynol a phlant yn glanhau'r dŵr glaw

4. Mae gwerddach'r coed sy'n plant yn amgugol'r dŵr glaw

5. Mae pibell o dan yr ardd law yn chwytho'r dŵr i'r afon

Gwella Bioamrywiaeth

Mae gardd law yn rhywle lle gall adar a phyllyd fyw a bwydo



Cymuned Werddach

Gall gardd law helpu i wneud y stryd yn fwy deniadol



Cyn

Ar ôl

Buddion eraill gardd law

- Addysg
- Iechyd a lles
- Cysylltu pobl â byd natur
- Aratu trafllug



Wales

- How did things change in Wales?
 - National Government & regulation
 - DCWW's position – no shareholders
 - SWEAR Policy for DCWW (Surface Water and Elimination Reduction Strategy)



Not only is the UK (dis)integrating.... But the approach is one of a dis(integrated water cycle)

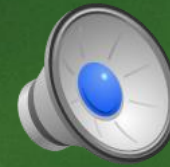
- Elsewhere (than England) the water cycle is being joined up
- And... planning processes are the focus (including water) in developing blue-green infrastructure ideas



- In all of this the biggest mess is in England...HBF rule OK!

But... this year is year one in PP time in England..

And... instead let's send in the clowns..



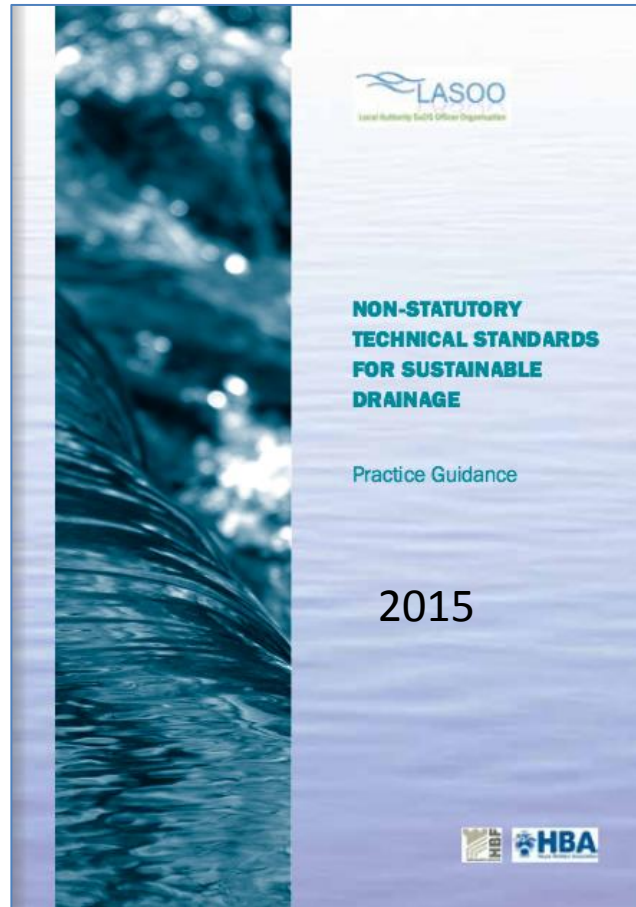
- Some of England's malfunctioning..



- Government challenged for failing to protect English waters (28th August 2015):
 - “High Court has granted WWF-UK, the Angling Trust and Fish Legal permission to bring a judicial review of the Environment Agency (EA) and DEFRA’s implementation of the Water Framework Directive (WFD).
- One response to the EA’s recent consultation on updated RBMPs said land management had lagged behind other sectors in reducing pollution and urgent action was needed by designating WPZs.”
- All this without even considering the chronic air pollution in many UK cities



Diverse
standards
(take
them or
leave
them)



Housebuilders in conference

Defra: *"Government remains committed to implementing SuDS at the earliest available opportunity, (but not in a way that has any adverse impact on development)"* 2014



Hey, leave
those
pipes
alone! (PF)



*We don't need no water treatment
We don't need no source control
No green benefits from the drainage*

Defra leave those developers alone

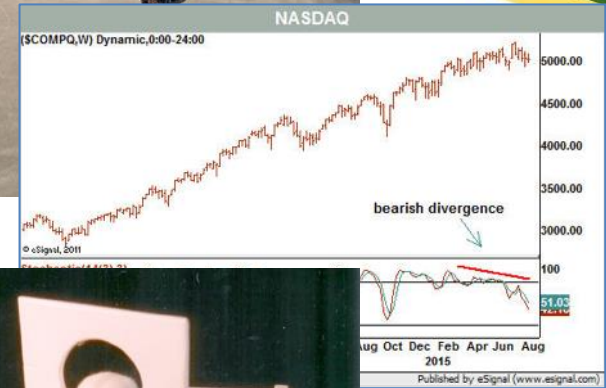
Hey! Defra - leave those developers alone

*All in all its just another pipe in the hole
All in all its just another pipe in the hole.
(Steve Wilson)*

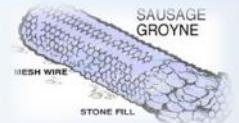


Although I'm talking about blue-green infrastructure and SUDS - how can and should we respond – my main points for today

- Question what we are doing and how we are doing it – to avoid 'lock-in' & 'lock-out'
- Listen to the science and plan longer term for complexity and uncertainty (this is not going to reduce!)
- Create agility in our processes and flexibility in (all) our systems (including institutions) because we don't know much...



❖ SAUSAGE GROYNES



- These are long, cylindrical, slightly flexible structures of variable thickness, composed of wire and rocks.
- Groynes are placed at the foot of banks along small, slow-moving streams, where there are signs of undermining and threats to permanent structures.
- Sausage groynes are designed to stop such action by allowing the bank to collapse to an angle of repose in such a manner as to form a moderate slope, which encourages the growth of vegetation.



Doing it for real



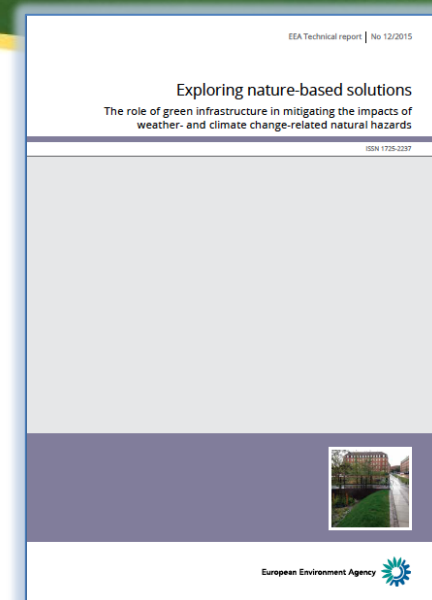
- There are no single 'problem' solutions
- We need to deliver widest possible societal benefits, often a moral justice approach (Smith, 1759; Sen, 2010; Lempert, 2014)
- Overall the most sustainable (flexible, resilient and economically cheaper and environmentally beneficial)
- There is no longer any option - we can only afford multifunctional infrastructure
- Requires changes in
 - Governance
 - Institutions
 - Regulations
 - Behaviours and attitudes
 - Especially on the part of professionals



Hang on – where's the GI in all of this?

Coming together... to do it..

- The MEA provided a legitimate foundation for valuing nature as infrastructure
- (We failed on the sustainability stuff)
- Us drainage people need to shift our thinking and actions to see all forms of water as potential assets/opportunities
- Nature and blue-green infrastructure (thinking) provides the vehicle for delivery... and gives planners and urban designers more of a role than we have been used to



Or *not*
coming
together to
do it
differently
....because
'we know
it works'

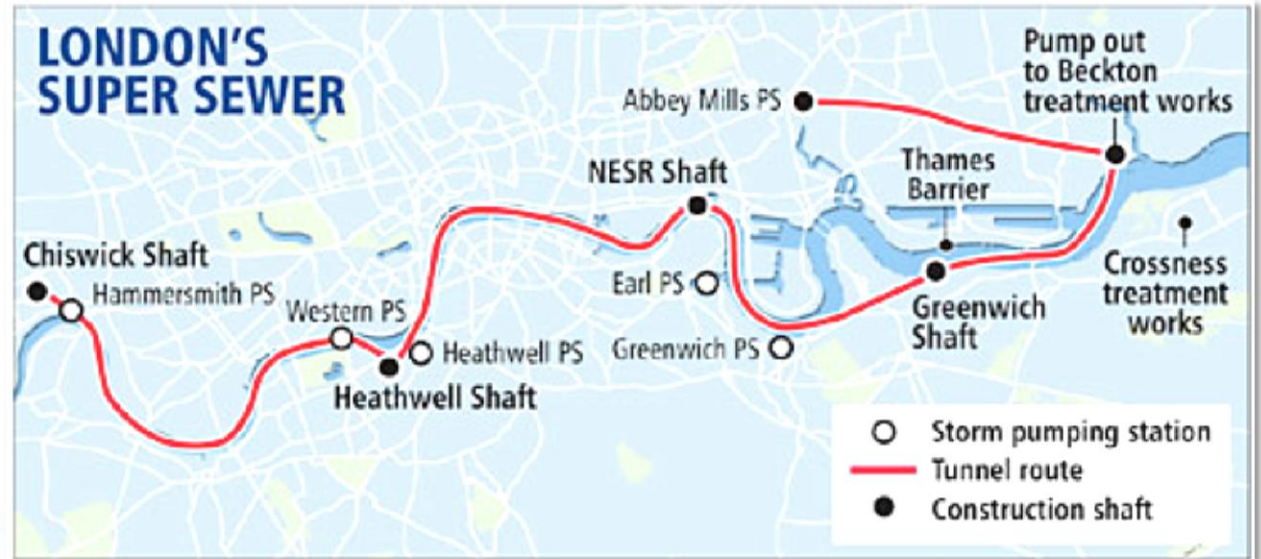
DEFRA commits to 25-year natural capital plan

By Rachel Salvidge, 22 September 2015 14:14 BST



Natural capital is to be incorporated into national and corporate accounts (photograph: Kevin Eaves/123RF)

DEFRA said it did not agree with the recommendation that an investment programme for **natural capital** should be integrated into the National Infrastructure Plan



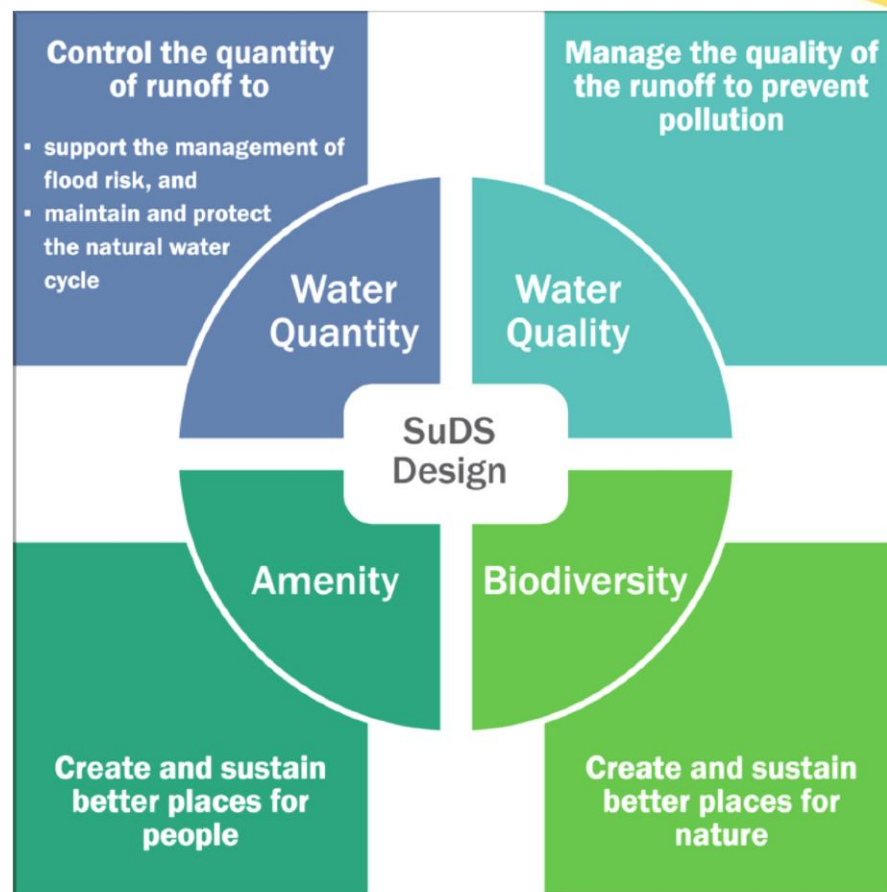
Really doing it

- It is happening...(yes, even in England)
- What does it look like?
- Are we/you recognising it?
- Do you GI'ers understand the opportunities us drainage folks can bring to what you are doing?



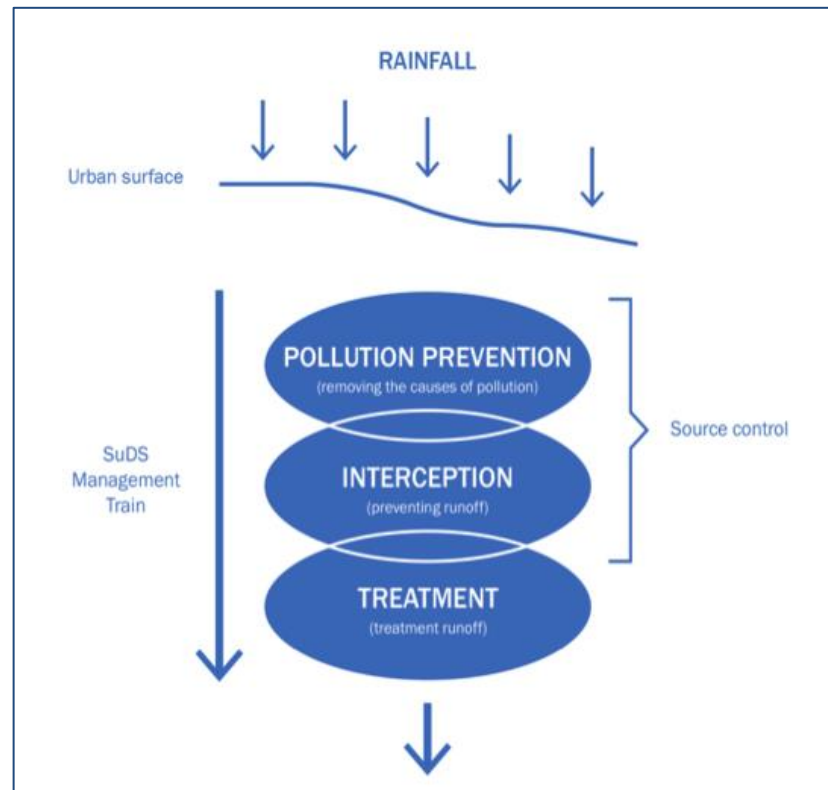
The new SuDS (manual)

Surface water runoff should be managed for maximum benefit



Not engineers by themselves

Who can
deliver on
these
criteria?



SuDS Manual 2015: Risk based pollution prevention

We understand that moving water on to the surface means we are interacting more with urban form and also building design

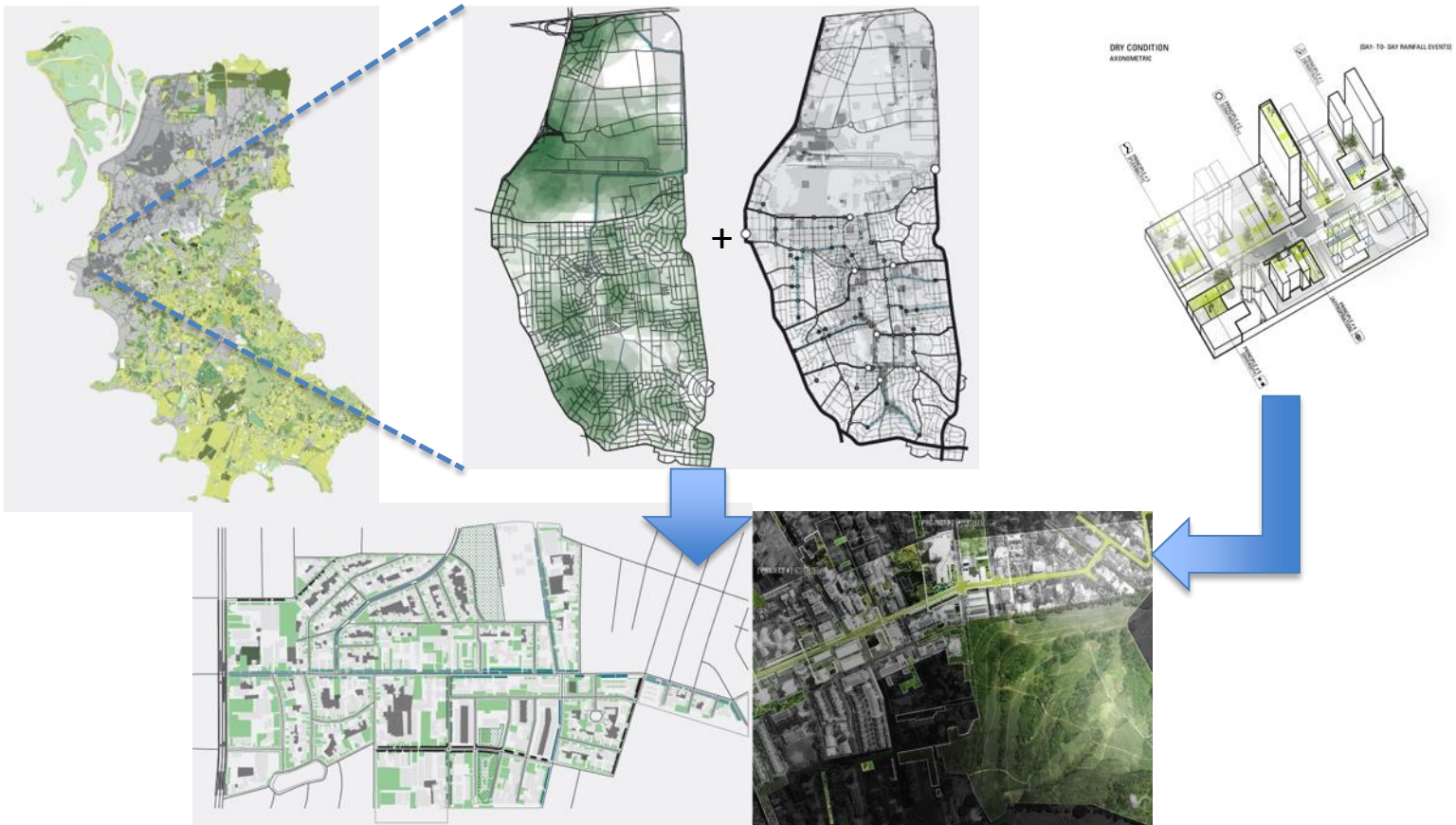


This means a lot of other professions are also involved

Maybe we can create infrastructure that has multiple functions?

Starting with nature as infrastructure

Land use map for the city of Porto Alegre, Brasil



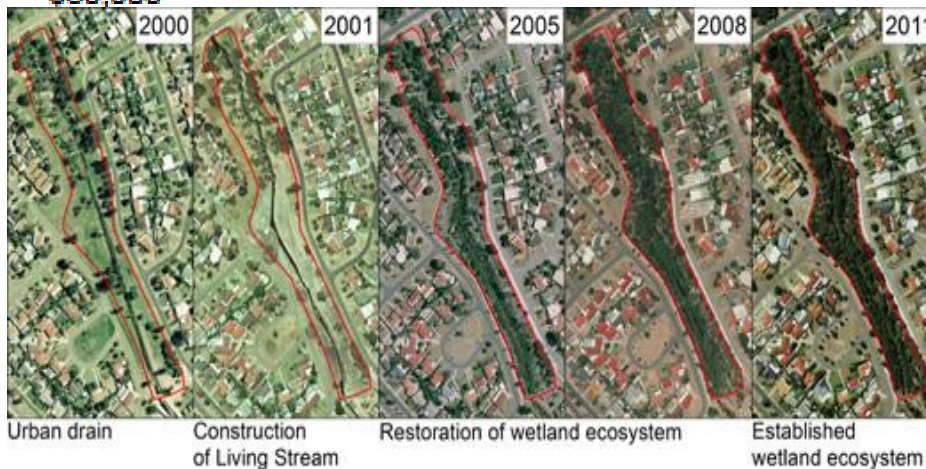
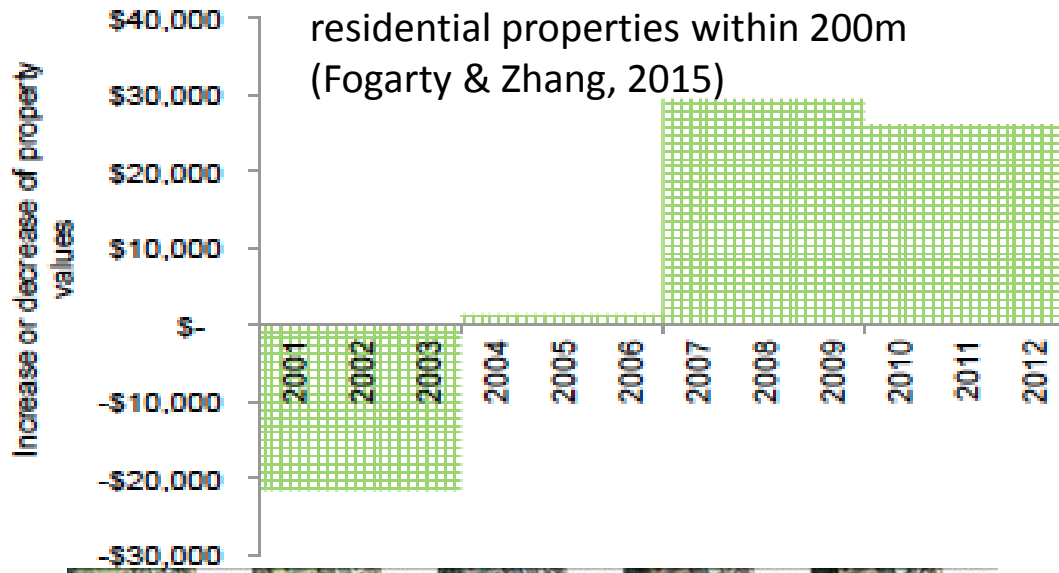
New SuDS valuation tool - BeST Potential/ monetised benefits



Benefit Category	Priority	Quant.
Air quality	1	✓
Amenity / Liveability	1	✓
Recreation	1	✓
Biodiversity (habitats)	1	✓
Carbon (comparison and sequestration)	1	✓
Flood risk	1	✓
Pollution control	1	✓
Reduced treatment / pumping	1	✓
Population growth / network capacity	2	✓
Air temperature	2	x
Groundwater recharge – maintenance of natural hydrology	2	✓
Health (range of benefits)	2	x
Urban form (possibly)	2	x
Water resource / rain water harvesting	2	✓
Crime	3	x
Economic growth	3	x
Education	3	x
Flexible infrastructure / CCA	3	x
Noise – (unlikely)	3	x
PR – business / CSR	3	x
Tourism (possibly)	3	x
Traffic calming (reduced accidents)	3	x

Value of restoring urban streams

Bannister Creek – value of residential properties within 200m (Fogarty & Zhang, 2015)



Our Vision

Cities and towns of the future will be sustainable, productive, resilient and liveable

The **CRC exists** to help change the way we build our cities by valuing the contribution water makes to economic growth and development, our quality of life and to the ecosystems of which cities are a part.

Mayes Brook Park East London

A lifetime
benefit-to-
cost ratio of
some £7 of
benefits for
every £1
invested

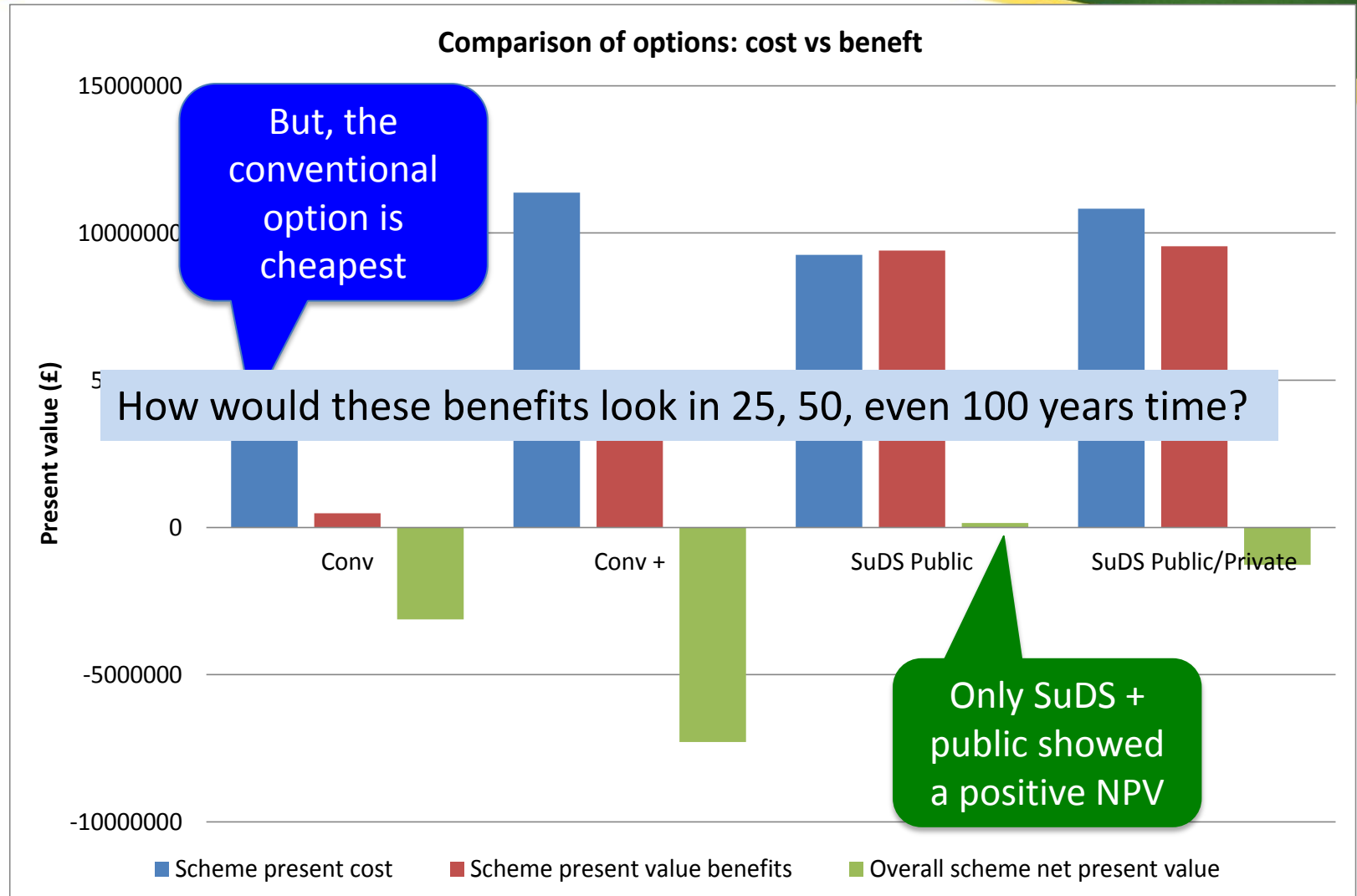
(93% of
benefits were
for cultural
services)



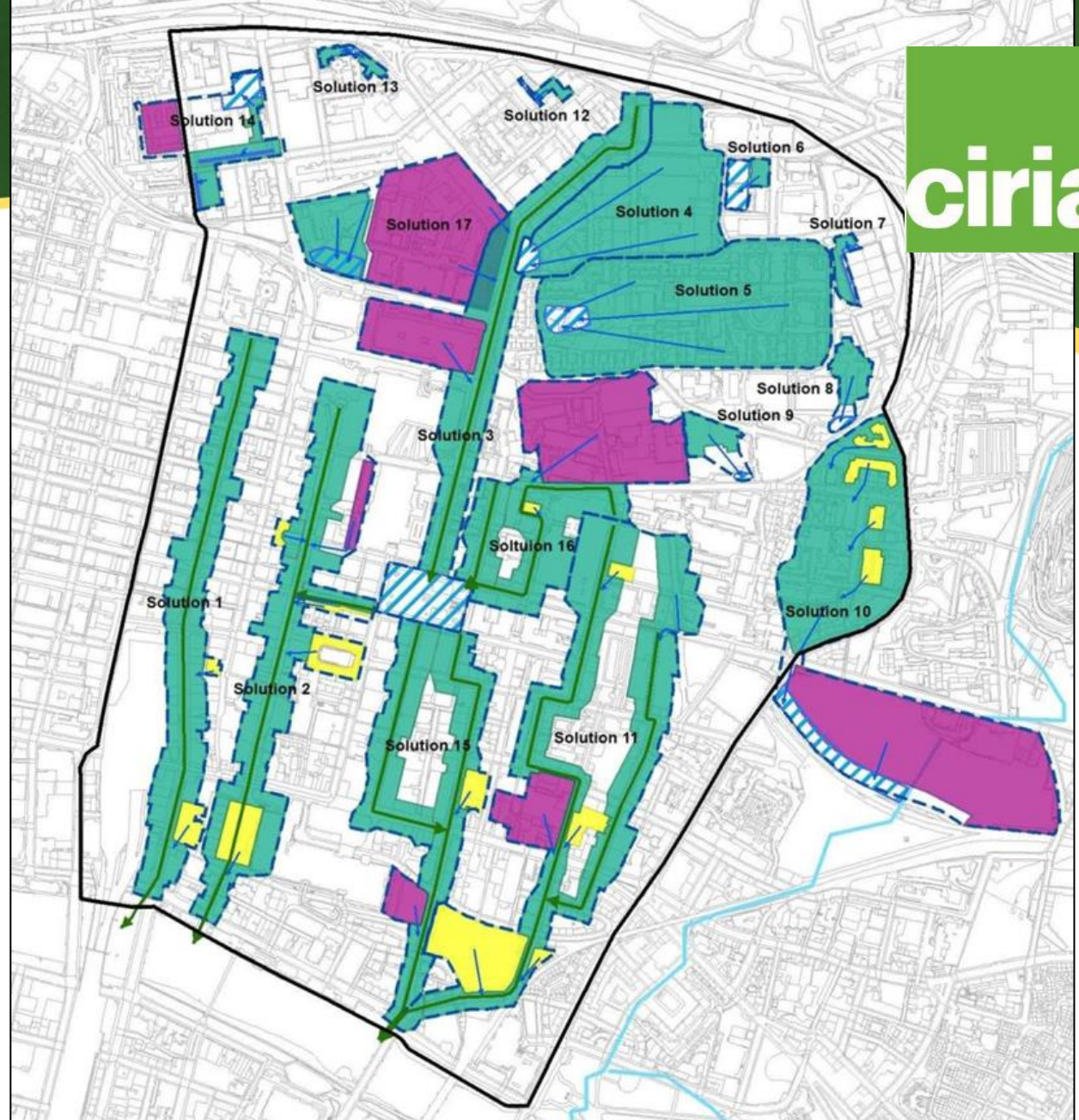
Applying BeST – Retrofit Case Study



Managing CSO spills in Yorkshire



Applying BeST – Glasgow SWMP



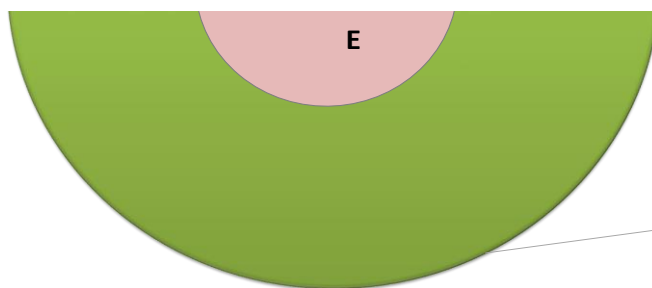
Applying BeST – Glasgow SWMP

Individual Benefits (Present Value) (Pre-Confidence)

Individual Benefits (Present Value) (Post-Confidence)

Enabling development, Carbon reduction and sequestration, Health, Recreation, Enabling development, Carbon reduction and sequestration, Amenity

Present Value Assessment Stage	Total PV Benefits	Total PV Costs	Net Present Value	Benefit Cost Ratio
Present Value before confidence applied	£69,858,591	£26,833,659	£43,024,932	2.6
Present Value after confidence applied	£62,707,500	£26,833,659	£35,873,841	2.3
Present Value sensitivity - low	£34,363,669	£26,833,659	£7,530,010	1.3
Present Value sensitivity - high	£99,782,635	£26,833,659	£72,948,976	3.7

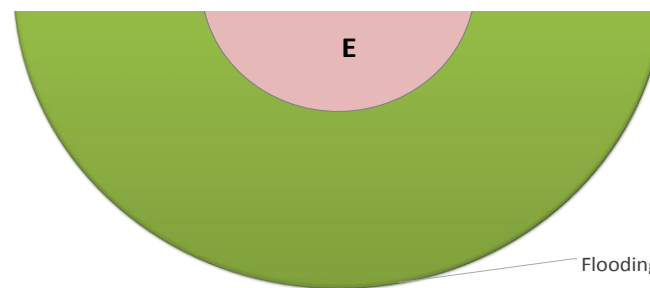


Flooding



Enabling development
Flooding
Amenity
Recreation

Carbon reduction and sequestration
Water quality
Health

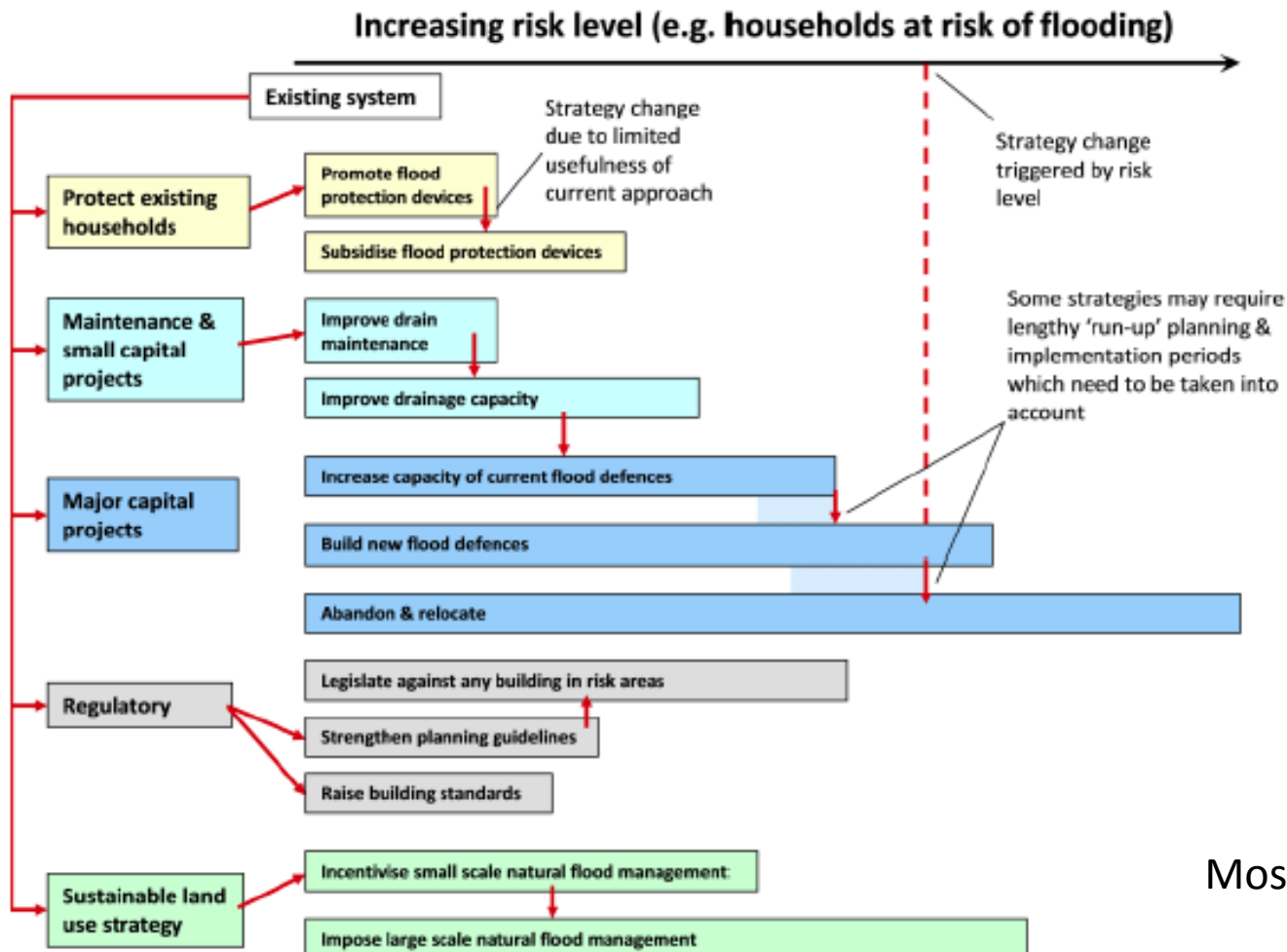


Flooding

Enabling development
Flooding
Amenity
Recreation

Carbon reduction and sequestration
Water quality
Health

Building in flexibility and adaptability – it's more than contingency planning



Moss & Martin (2012)

What about mainstreaming – taking advantage of (other) developments – synchronicity and piggy-backing?

Exploring and assessing the opportunity

Seizing the opportunity



Is the project effective?

Does the project provide enough added value??

What are the constraints of the project?

Is the project financeable?

What are the requirements from maintenance and operation?

What are the requirements from the realisation phase?

There are multitudes of opportunities to bring BGI into 'normal' development, redevelopment, retrofitting...

- Activities required
- Effectiveness
- Stakeholders
- Feasibility in time and budget

- Willingness of stakeholders to contribute (€ or other)

- Inter-species planning procedures (Functional) design specifications
- Interdependencies between parts of the projects
- Critical factors in the context of the site
- Critical time schedule

- incl. financing structure
- Risk allocation and management
- Tasks and responsibilities in the executive project organisation

- Monitoring and knowledge management procedures
- Evaluation (criteria)

- design specs
- Risk management with contractor
- Contract management / scope management
- Stakeholder management

Opportunities?

More than 100 years of engineers dealing with the 'problem' of water, flooding and sanitation

Can we not do a bit better?

Water is but one of the components of the liveable city – albeit a critical component



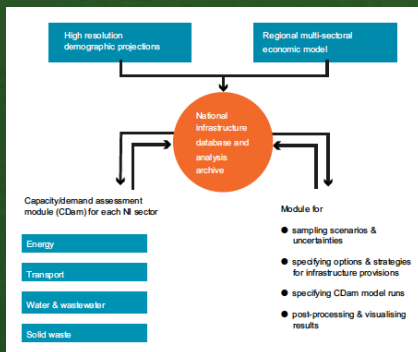
SuDS help us to manage water as an asset and as part of an integrated cycle
- WSUD



Summarising

Changing
what we do

- Pipe-bound 'solutions' deal with a single issue
- Society needs much more value from its' infrastructure and services
- We seem to need to monetise everything
- Evidence now emerging via new tools
- It also needs interacting infrastructure in systems of systems – 'smart' functioning
- WSUD may be more relevant



Systems of systems (Hall et al 2013)

Uptown Normal, Illinois Circle and Streetscape

Award winning multi-functional public space. As well as being a roundabout, it collects runoff from surrounding streets to alleviate downstream flooding, infiltrates, stores, purifies, provides reuse water some of which is used for cooling the area and the space, abates surrounding vehicle noise, and provides a recreational facility hosting rock and blues festivals.



Where
does that
leave us?

Now it's
(just)
another
show..... So
leave them
laughing
when you
go...



Old friends they're acting
strange, they shake their heads
and tell me I've changed...(or
not in my case).. Clouds got in
the way

Yep, it's no longer just
engineering or engineers..
'model says' isn't good enough

....from give and take and still
somehow (we) really don't
know SuDS at all... *or do we?*

The ugly



Ugly and bad