Multi-functional, multi-benefit and valuable – dumping the pipe-bound mentality and managing stormwater using green infrastructure

Richard Ashley EcoFutures Ltd.

The University Of Sheffield.

UNESCO-IHE Institute for Water Education

Using evidence from working in projects with:

ciria

EcoFutures

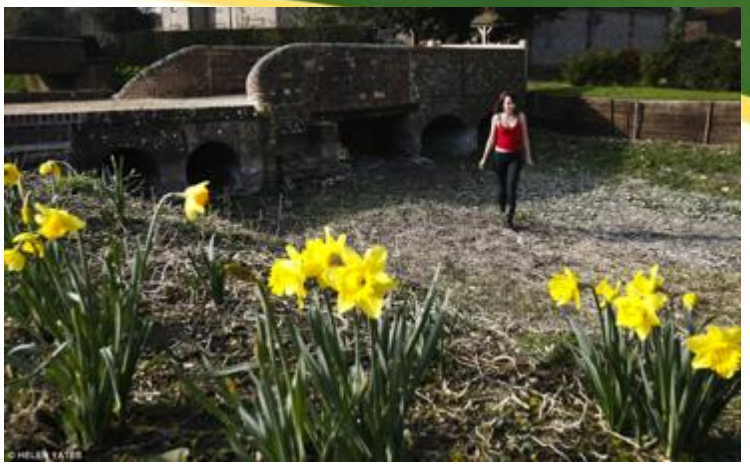
Halcrow A CH2M HILL COMPANY

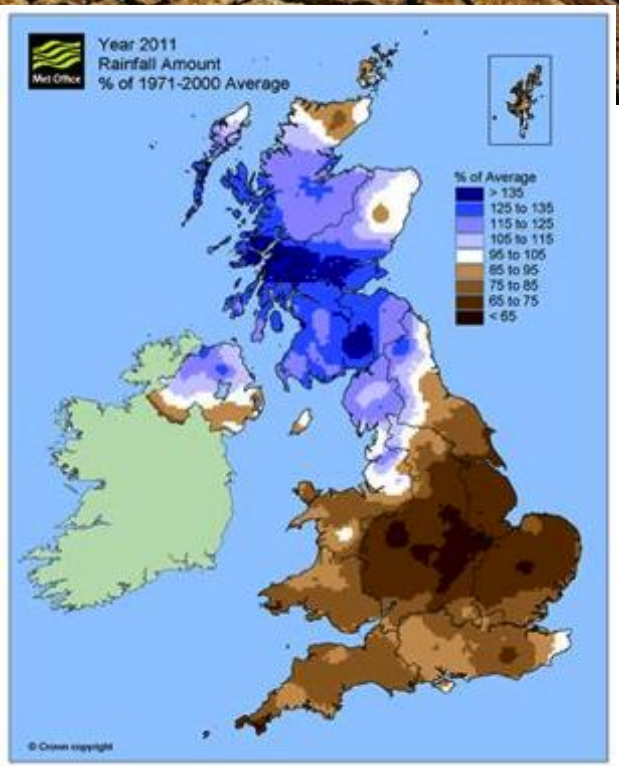
MWH BUILDING A BETTER WORLD

CRC for Water Sensitive Cities

Problems…


England Spring 2012




Year 2011
Rainfall Amount
% of 1971-2000 Average
% of Average
> 135
125 to 135
115 to 125
105 to 115
95 to 105
85 to 95
75 to 85
65 to 75
< 65


20th February 2012
SE England officially
declared to be in drought

Problems..


England winter 2013-14

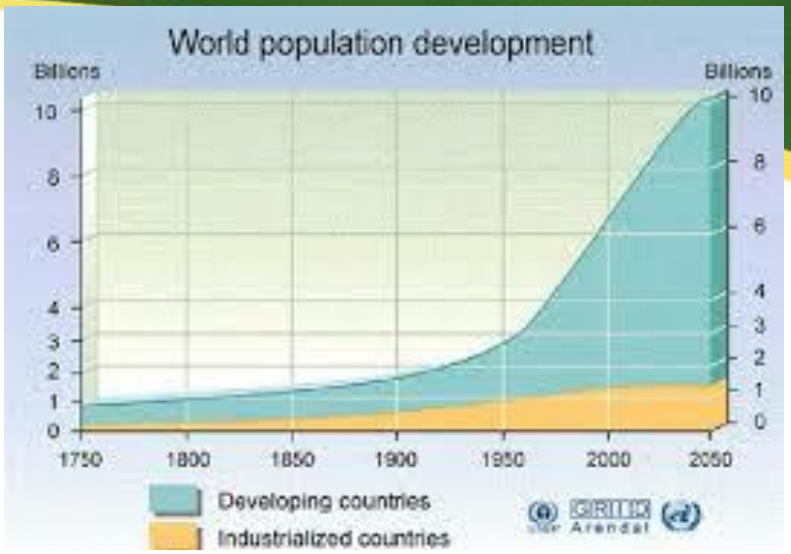

Thames Meadow
Sheppertan
Private Road
No Access to River
10 mph
Weight limit 17 tonnes


10

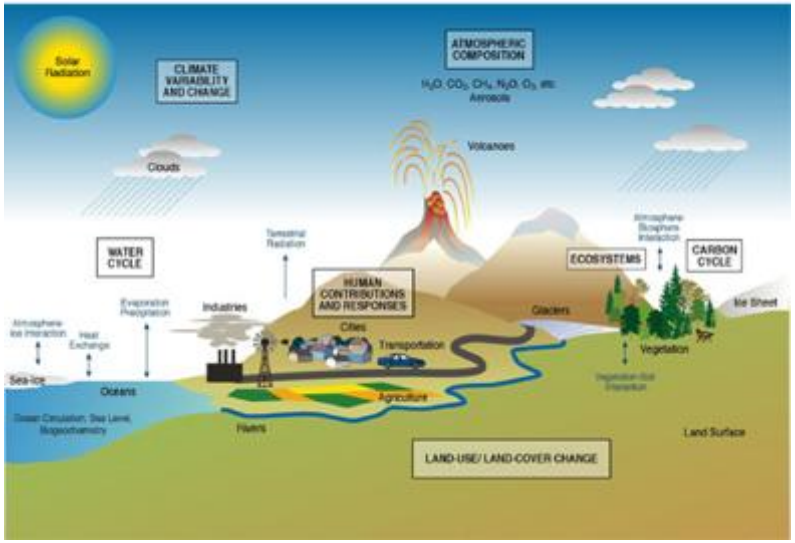

England Autumn 2012

Problems …

Problems…


World population development
Billions
Billions
10
8
6
4
3
2
1
0
1750
1800
1850
1900
1950
2000
2050
Developing countries
Industrialized countries
CICERO
Arendal


Understanding the urban challenge?
Inability to cope with demand for services
Disparities between the rich and the poor
Is there such a thing as sustainable urbanization?
Diversion of resources to safety and security
Insecurity and social unrest
7
UN HABITAT


Solar Radiation
CLIMATE VARIABILITY AND CHANGE
ATMOSPHERIC COMPOSITION
Volcanoes
Clouds
WATER CYCLE
ECOSYSTEMS
CARBON CYCLE
HUMAN CONTRIBUTIONS AND RESPONSES
Industries
Cities
Transportation
Glaciers
Vegetation
Sea-ice
Oceans
Agriculture
Rivers
Land Surface
LAND-USE/ LAND-COVER CHANGE

Or opportunities?

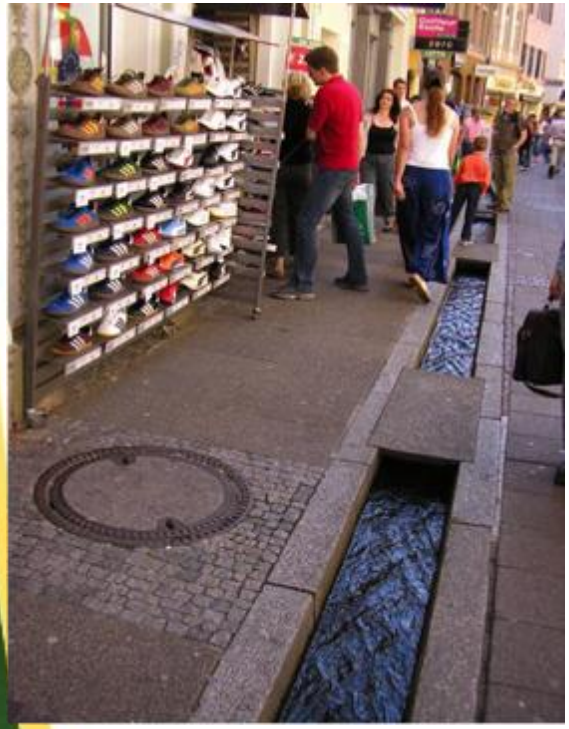
More than 100 years of engineers dealing with the ‘problem’ of water, flooding and sanitation

Can we not do a bit better?

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

Water in all it's forms is an Opportunity

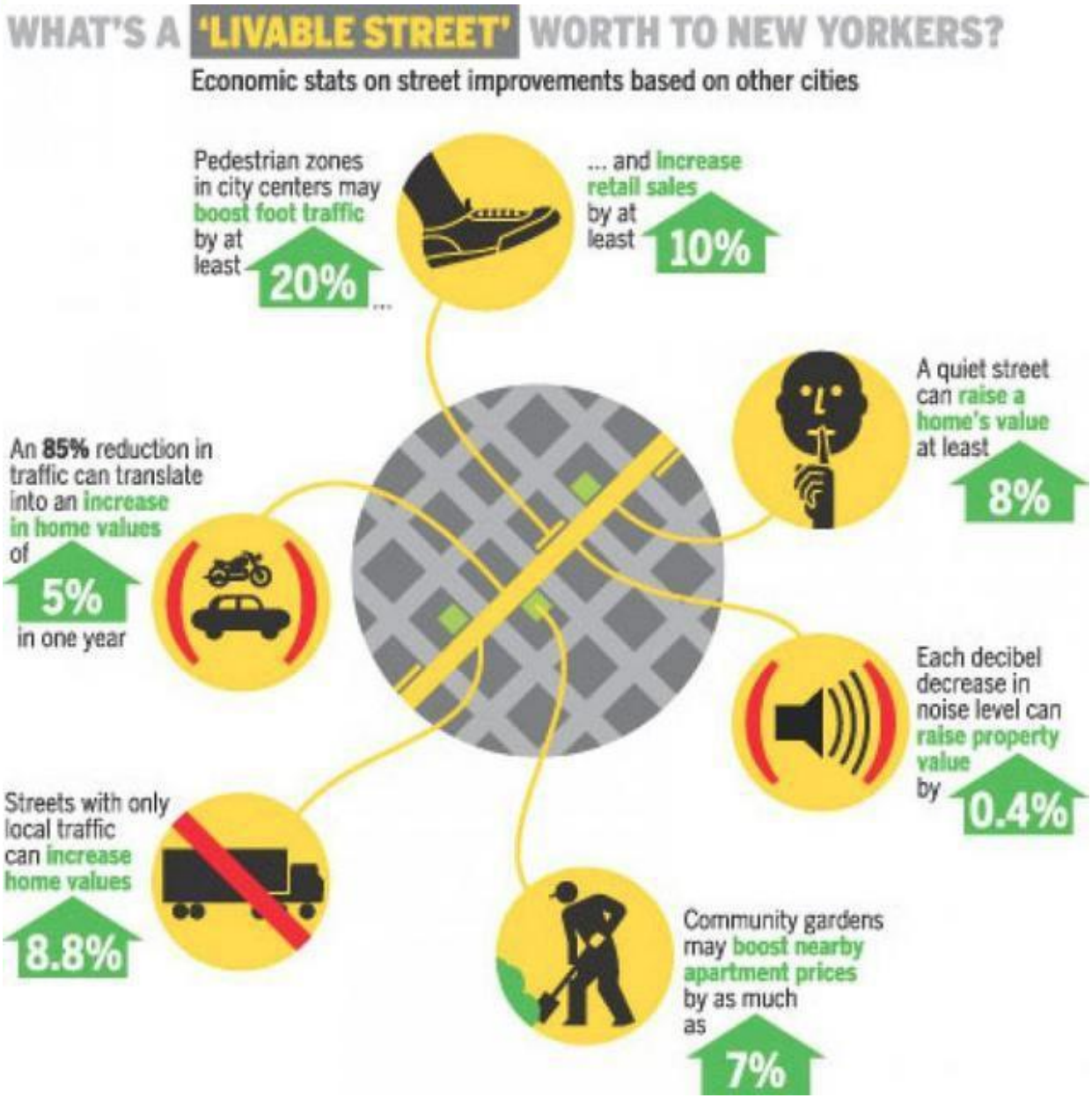
Cheonggyecheon Stream Restoration, Seoul (Images: Korea Tourism Organisation)



Stormwater Drainage as an Urban Feature, Freiberg (Image: Leanne Hodyl, 2004)

Woonerf, Netherlands (Image: wiseearth.org)

Liveability



What has water to do with liveability? Examples (De Haan et al, 2014)

Human Needs	Category	Social need	What it is	Provided by Water and BG
Existence	Physical and material needs	Potable water	Safe and secure supply	Harvesting at source
Related-ness	Social interaction and inter-personal relationships	Social cohesion	Safe and secure places for people and nature to interact	Local stormwater management by local people
Growth	Societal self-esteem and actualisation	Control and indepen dence	Choice and influence on decisions about water	Water Framework Directive promotes emphasis on people

These of course are very nice.. But ..what about the important stuff?

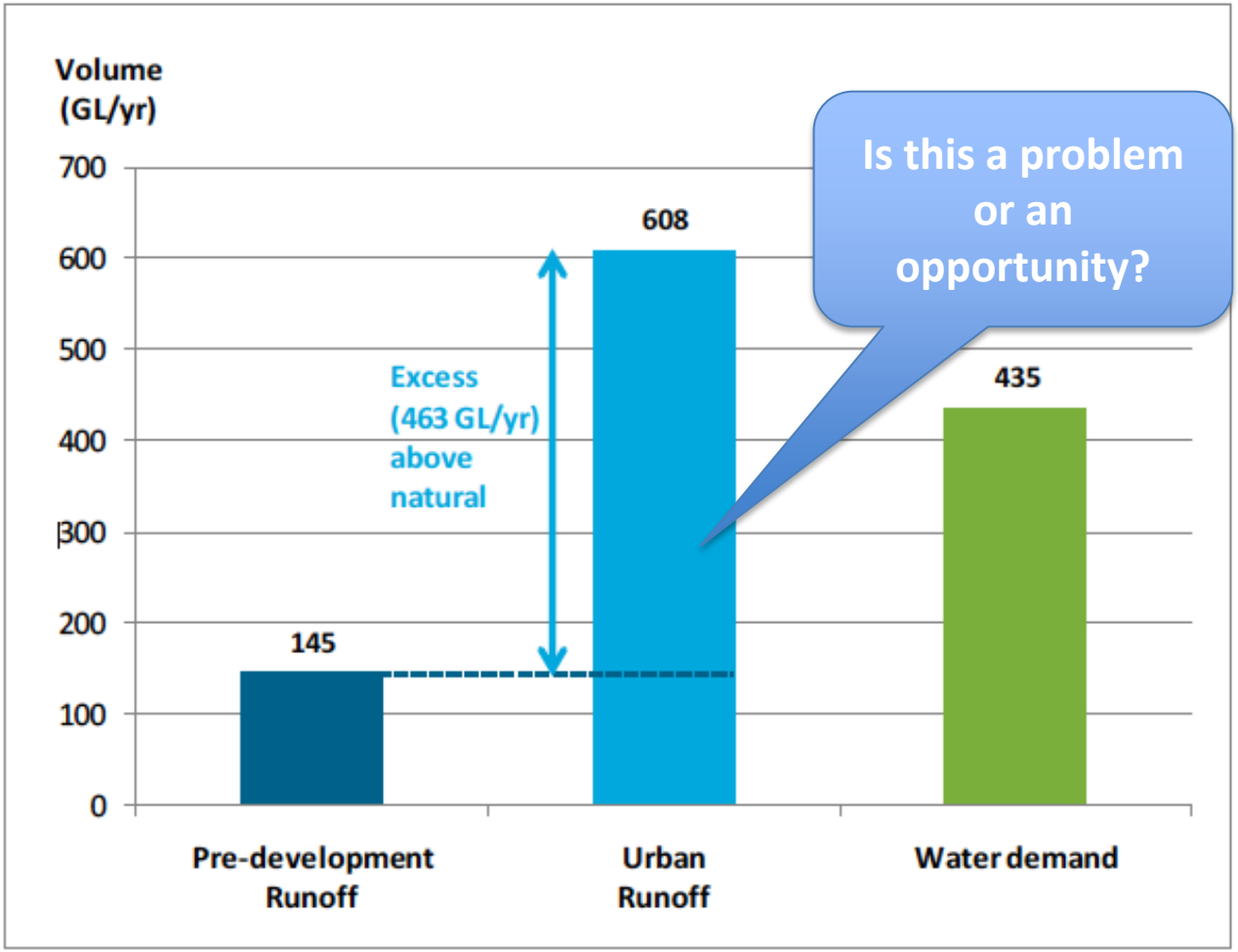
Urban horticulture Schilderswijk WestenbergHof, Den Haag, Netherlands (Images: Stroom Den Haag, 2010)

Edible Garden, Pizzeria Mozza, Los Angeles (Image: ecooutdoor.com.au)

Street Verge Gardening (Images: Grayson, 2010)

What about the REAL issues?

Water supply



Runoff from the Melbourne Metropolitan area prior to and after urbanisation

CRC for Water Sensitive Cities

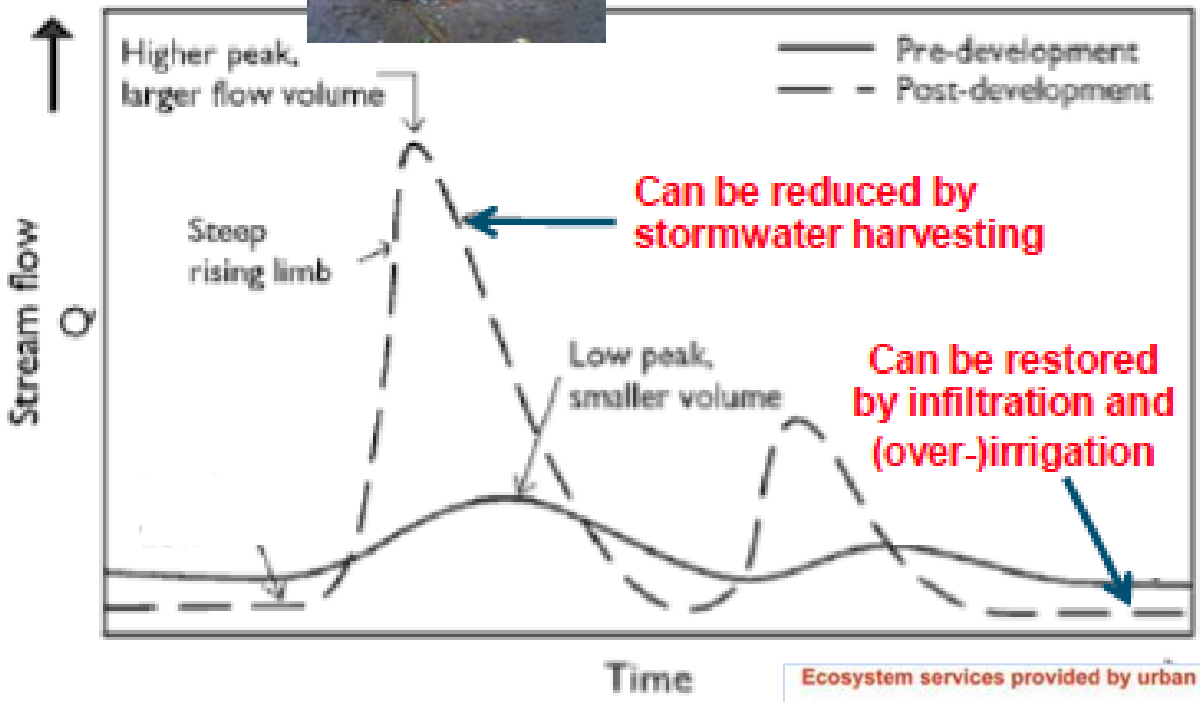
Surface water as a resource

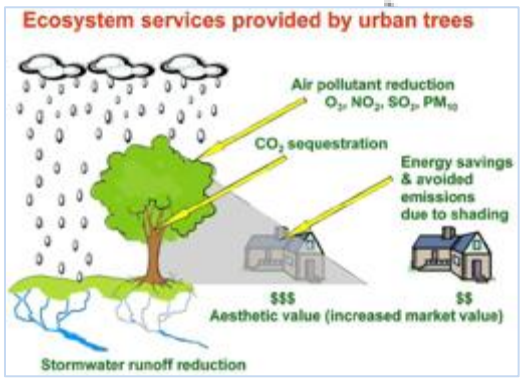
helps deal with FLOODS

also with POLLUTION

CRC for Water Sensitive Cities

Can deliver many and multiple benefits by managing the SOURCE





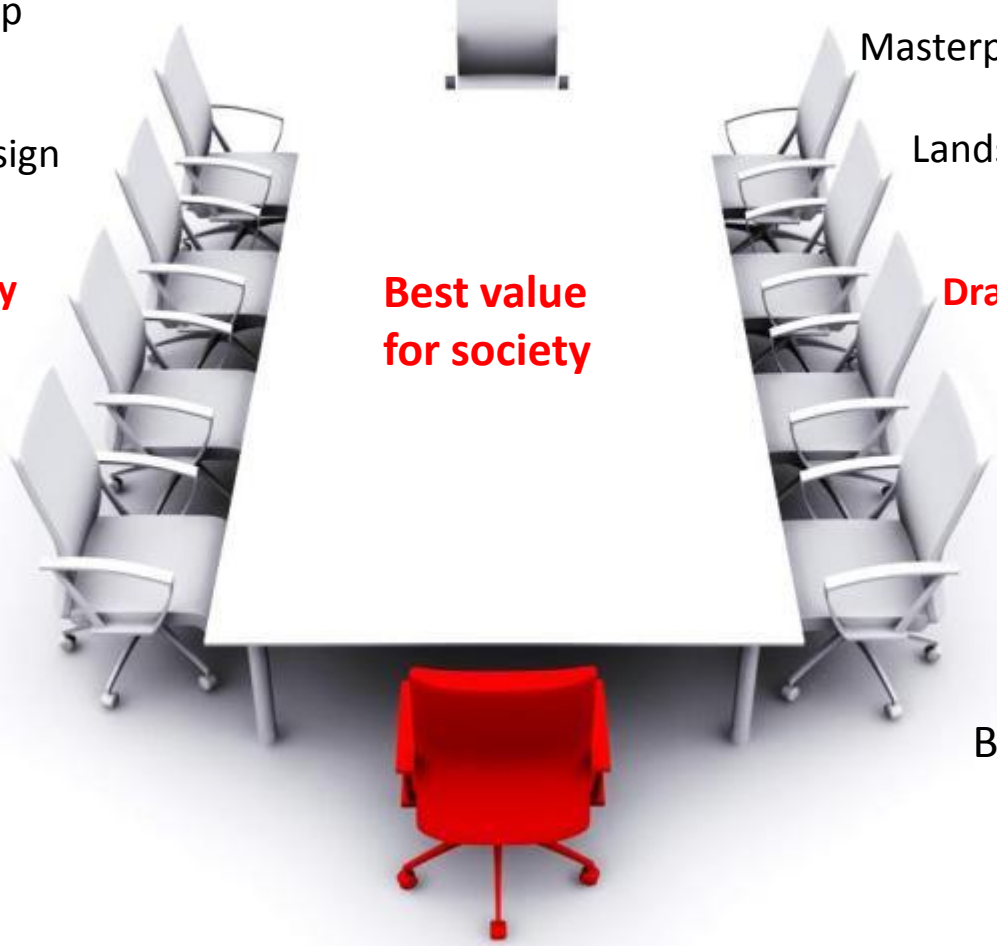
CRC for Water Sensitive Cities

Doing it for real

Moving beyond 'pipe-bound' thinking and technology lock-in (treating the SYMPTOMS)

- Single 'problem' solutions
- We need to deliver widest possible societal benefits (Smith, 1759; Sen, 2010)
- 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

There are lots of people involved



Highways engineering

Project management and partnership working

Masterplanning

Urban design

Landscape architecture

Ecology

Best value for society

Drainage delivery

Planning

Development control

Place making and liveability

Rights of Way ?
Education ?

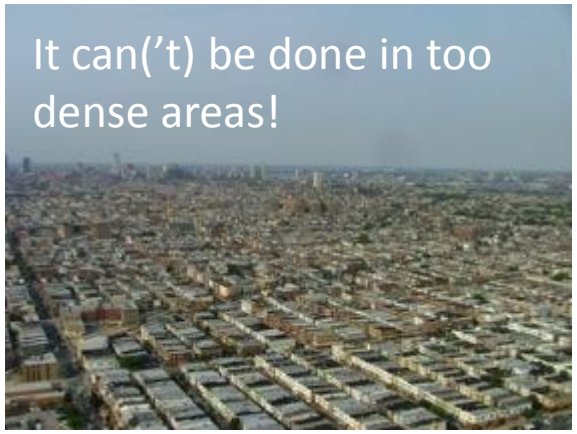
Business drivers

Strategic flood risk management

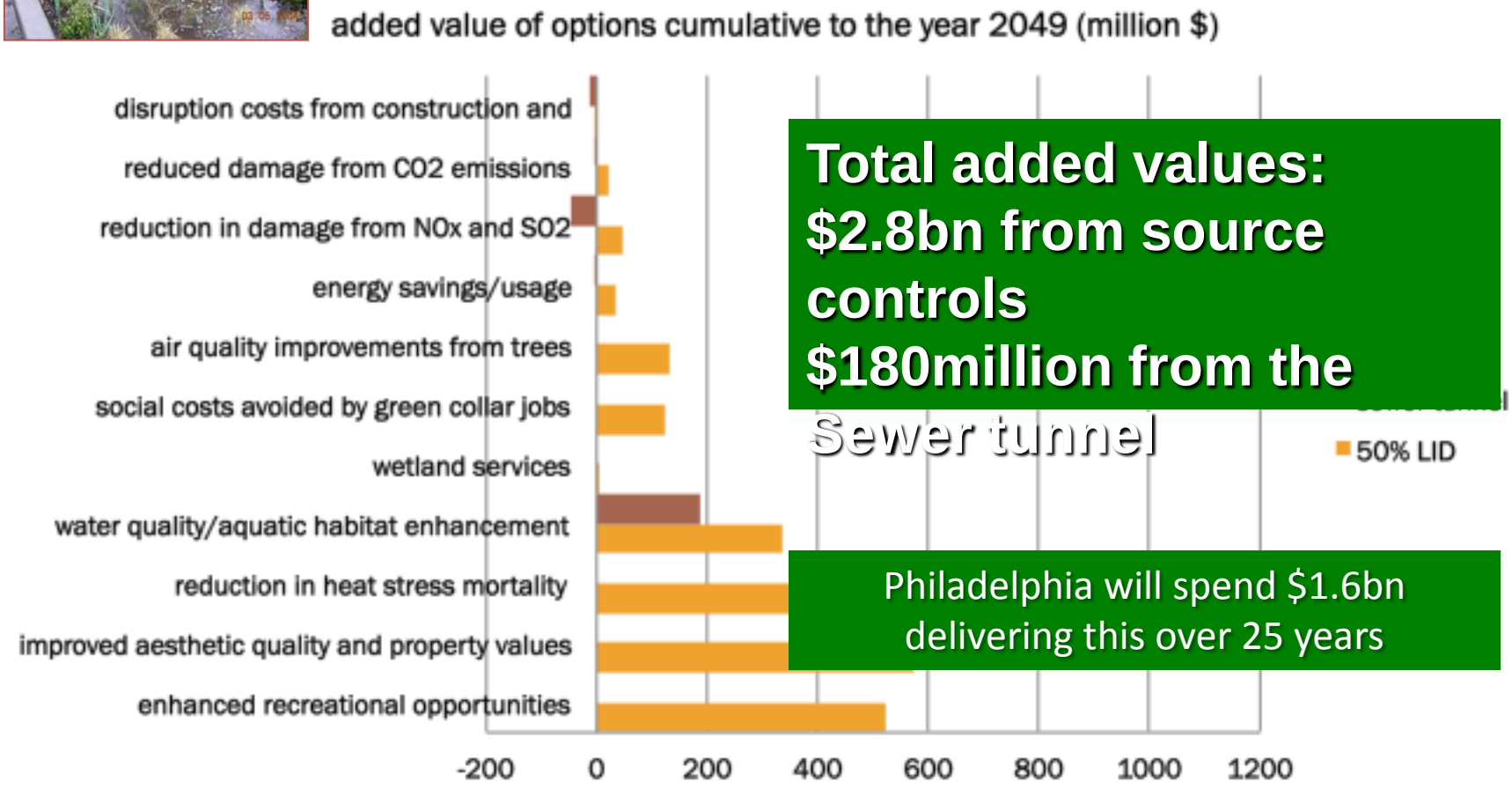
Doing it in Philadelphia's Green City water program(Maimone, 2012)

Population (11,379/ sq.mile)

the first 5 years were needed to re-write the ordnances for stormwater



Calculating added value from using green infrastructure



Total added values: $2.8bn from source controls $180million from the Sewer tunnel

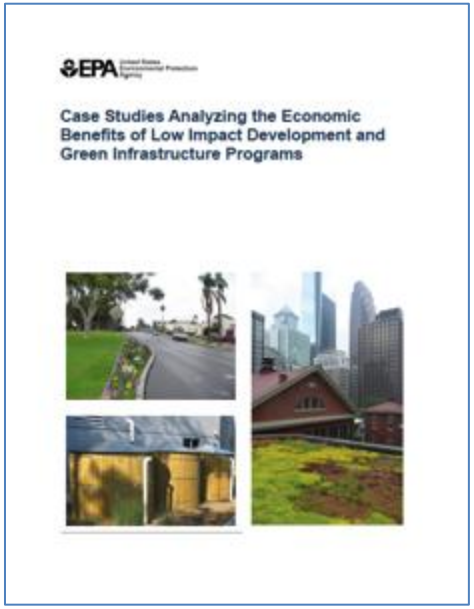
Philadelphia will spend $1.6bn delivering this over 25 years

US EPA 2013

reviewed 13 case studies demon-strating multiple benefits

Minnesota - A new storm sewer for conveying untreated, frequent floodwaters to Lake Como was estimated to cost $2.5m compared to $2.0m for GI infiltration.
LID/GI approaches also improve the quality of an economically important, nutrient-impaired recreational lake.

Iowa- although permeable pavement would initially be more expensive, the lower maintenance and repair costs result in cost savings overall.
Cumulative savings over a 57 year period were calculated to amount to about $2.5 million



What's different about Wales?

GREENER GRANGETOWN WERDDACH

Being done all over the place…Utrecht

40 properties per hectare

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)

Counters creek catchment

Changing what we do

Systems of systems (Hall et al 2013)

- Sadly we seem to need to monetise everything
- Evidence now emerging via new tools developing
- Pipe-bound ‘solutions’ deal with a single issue
- Society needs much more value from its’ infrastructure and services
- It also needs interacting infrastructure in systems of systems – ‘smart’ functioning

New valuation tool -

Potential 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

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.

It can and is being done