

Adapting a (coastal) site to the climate and extinction emergencies: a 'one planet' approach

David Thorpe
Guest lecturer

Projected sea level rise and Swansea in 80 years if the world average temperature rises 3 degrees.

Red =
under water



Sea level rise is only part of the problem

We're living off the future

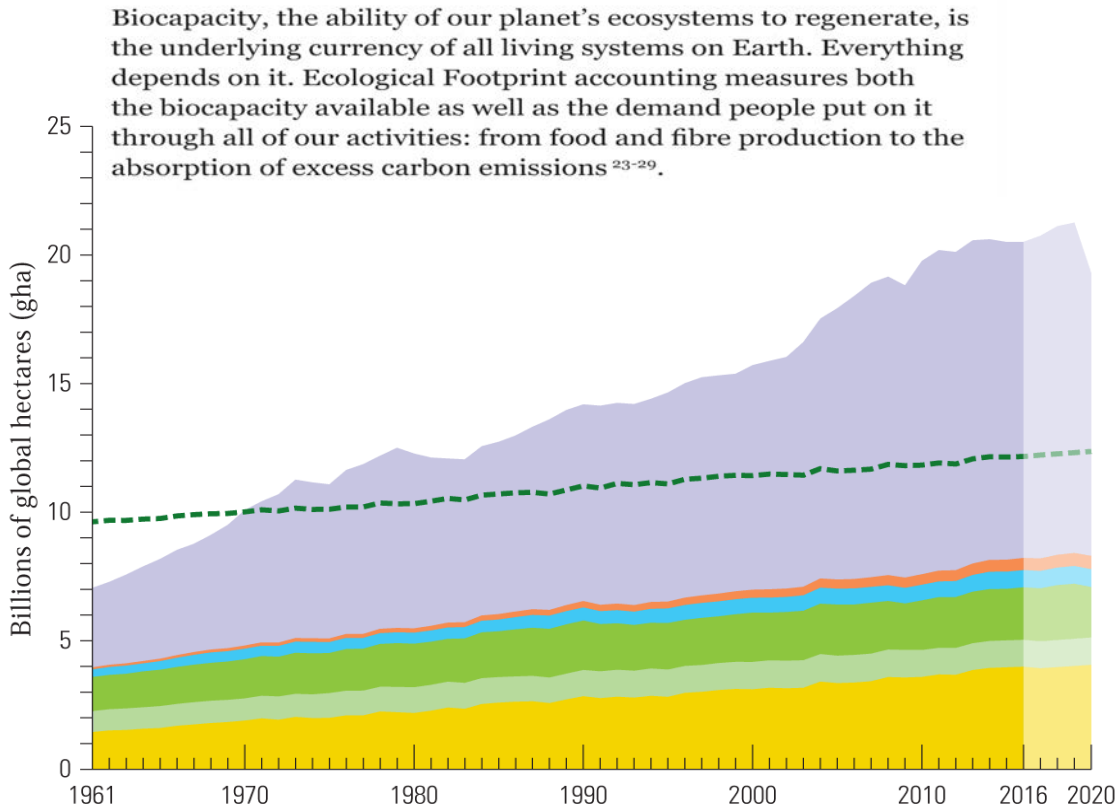


Figure 12: Humanity's Ecological Footprint against Earth's biocapacity in global hectares, 1961-2020

Global overshoot, starting in the early 1970s, has increased since. The COVID-19 related footprint contraction - in lighter colours from 2016 onwards - is an estimate^{30, 31}.

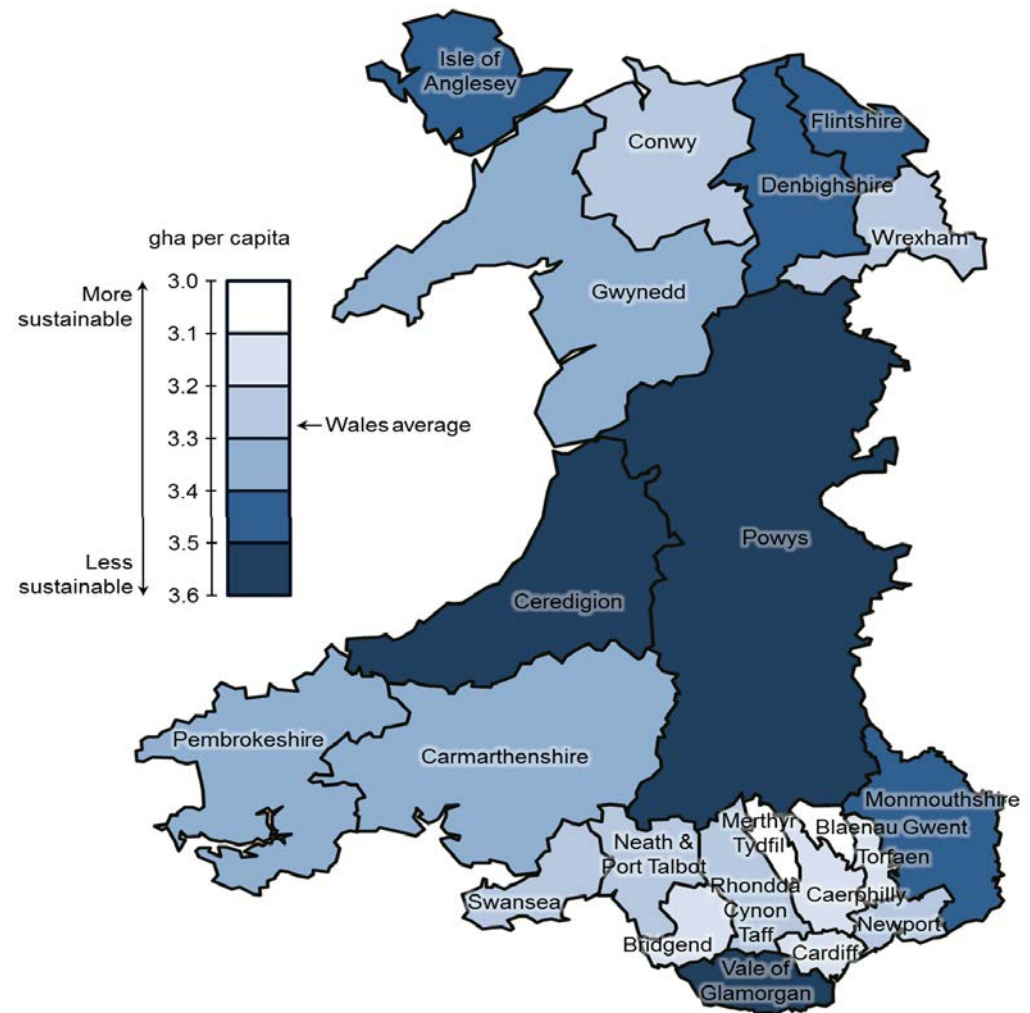
Key

- Carbon footprint**³⁴ for absorbing emissions from fossil fuel burning and cement production
- Built-up land footprint** for accommodating roads and buildings
- Fishing grounds footprint** for wild and farmed seafood from oceans and freshwater
- Forest product footprint** for fuel wood, pulp and timber
- Grazing land footprint** for meat, dairy, leather and wool
- Cropland footprint** for food, fibre, oil and feed crops, including rubber
- World biocapacity**

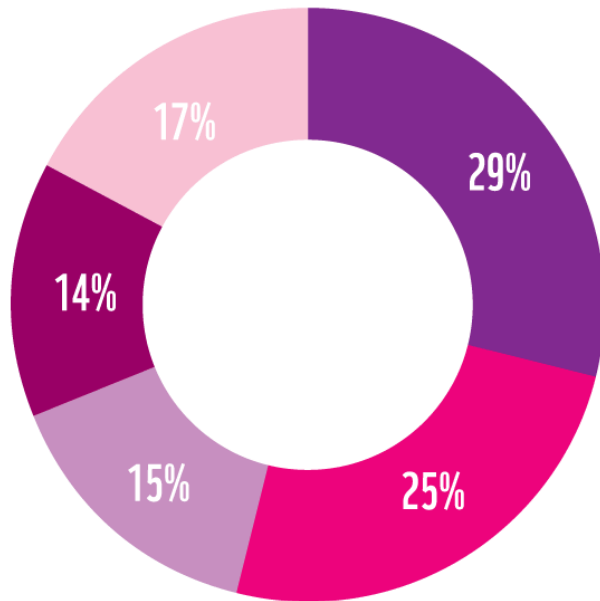
In Wales, we have a bigger problem!

Wales' ecological footprint is 5 times the size of Wales.

If everyone in the world were to consume the same as us we'd need 2.7 planets



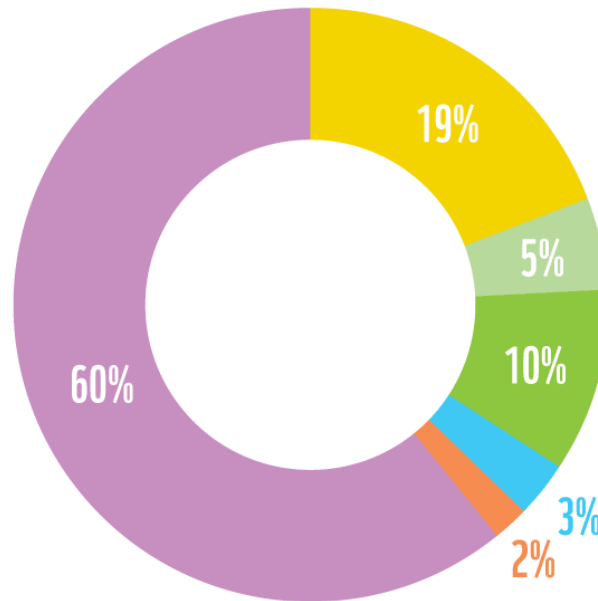
Breakdown of the footprint



Humanity's Ecological Footprint by activities

Key

	Food
	Housing
	Personal transportation
	Goods
	Services



Humanity's Ecological Footprint by land use

Key

	Cropland footprint
	Grazing land footprint
	Forest product footprint
	Fishing grounds footprint
	Built-up land footprint
	Carbon footprint

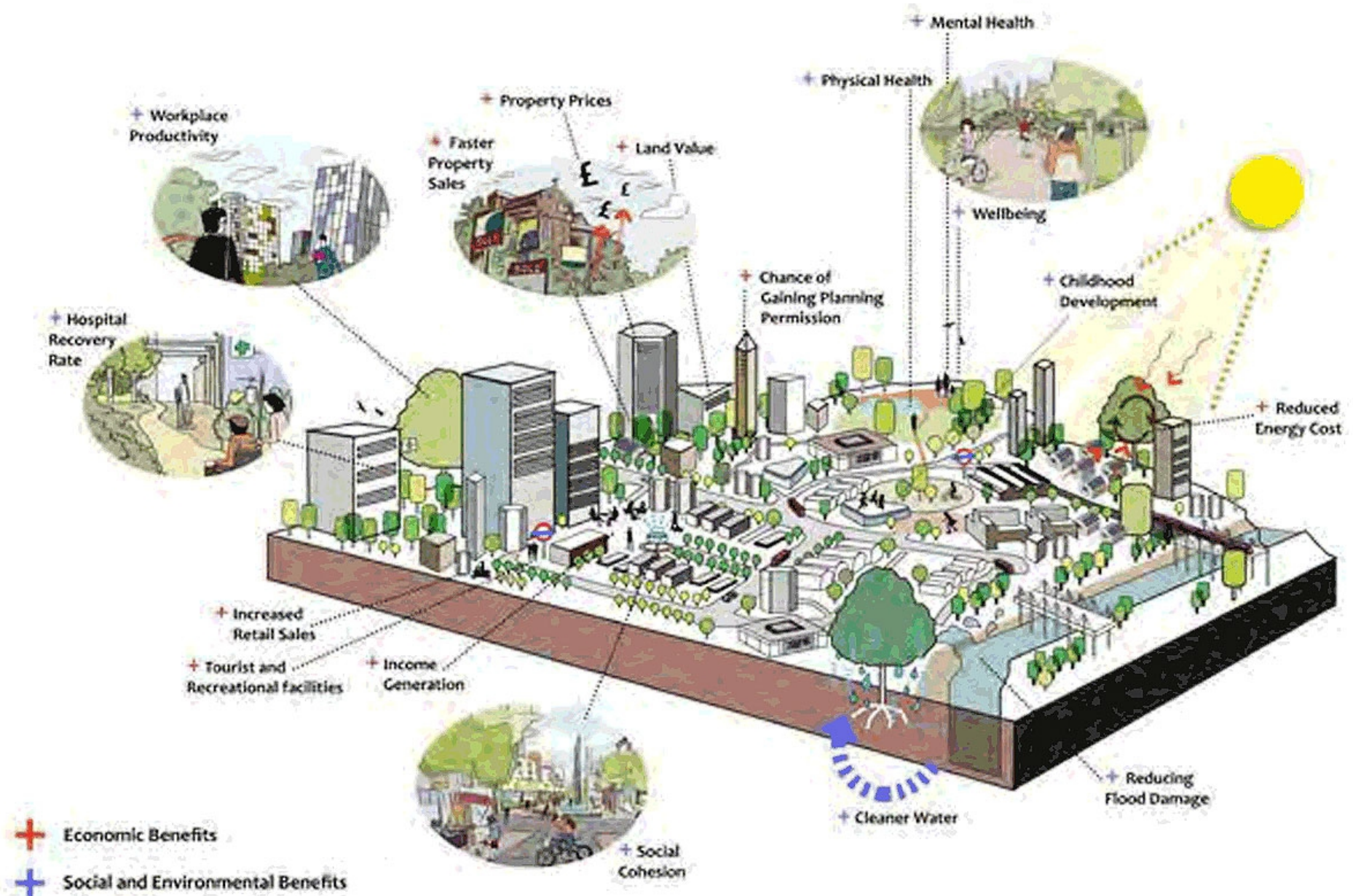
Figure 13: Humanity's Ecological Footprint by land use and by activities
The Ecological Footprint measures how much demand human consumption places on the biosphere and compares it to what ecosystems can renew. In 2020, the world average Footprint amounts to 2.5 global hectares per person, compared to 1.6 global hectares of biocapacity. It can be broken down by area categories (outer circle) or, using Multi-Regional Input-Output Assessments, by activity fields (inner circle)^{35, 30, 29, 36}.

So we look for “nature-based solutions”. Nature knows best! - work with her.

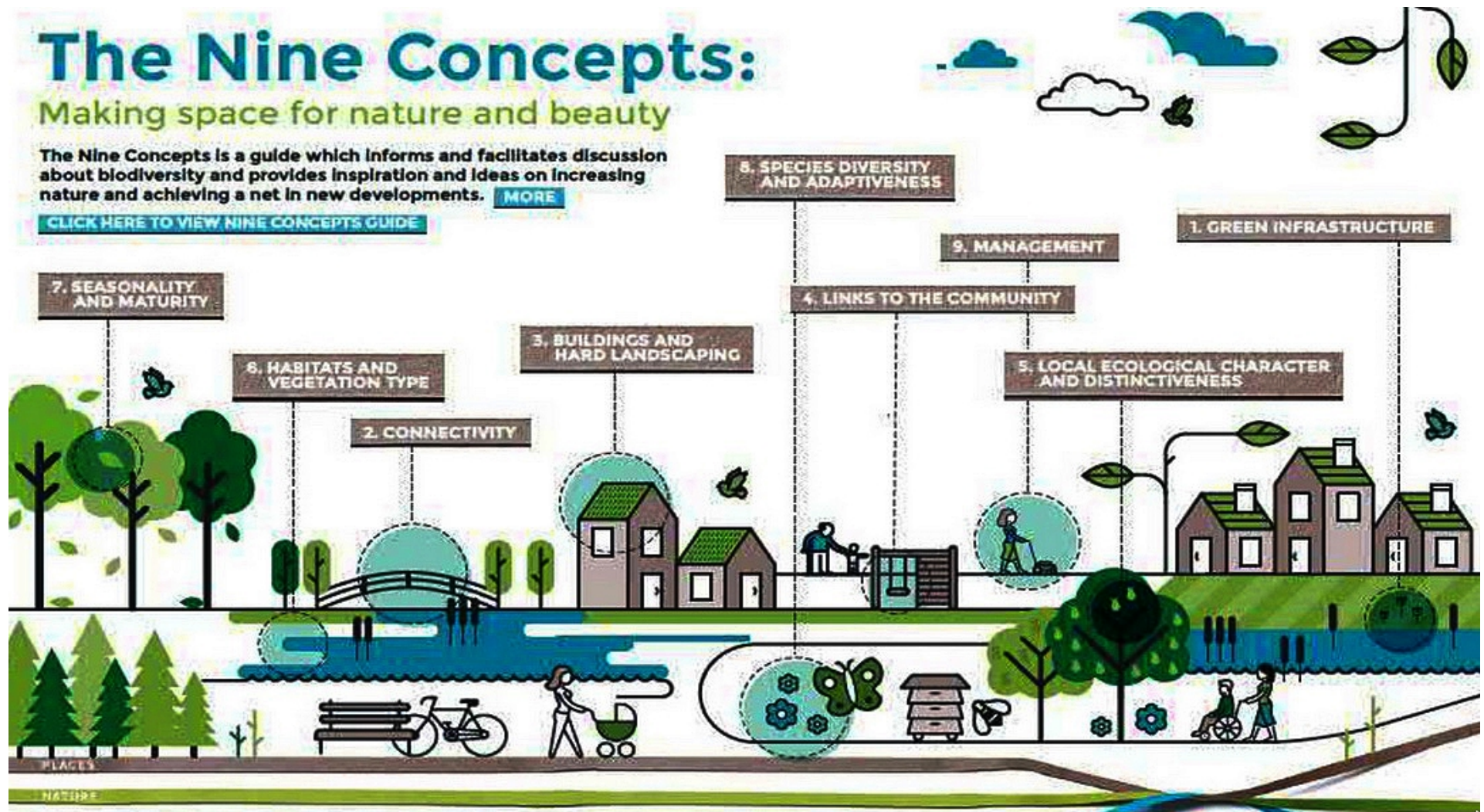
Freiburg, Germany and Amsterdam



Benefits of nature-based solutions



Principles of nature-based solutions



Living roofs



Environmental benefits

- Improves air quality
- Improves biodiversity
- Helps to manage water and improve water quality
- Helps us adapt to climate change by cooling our cities

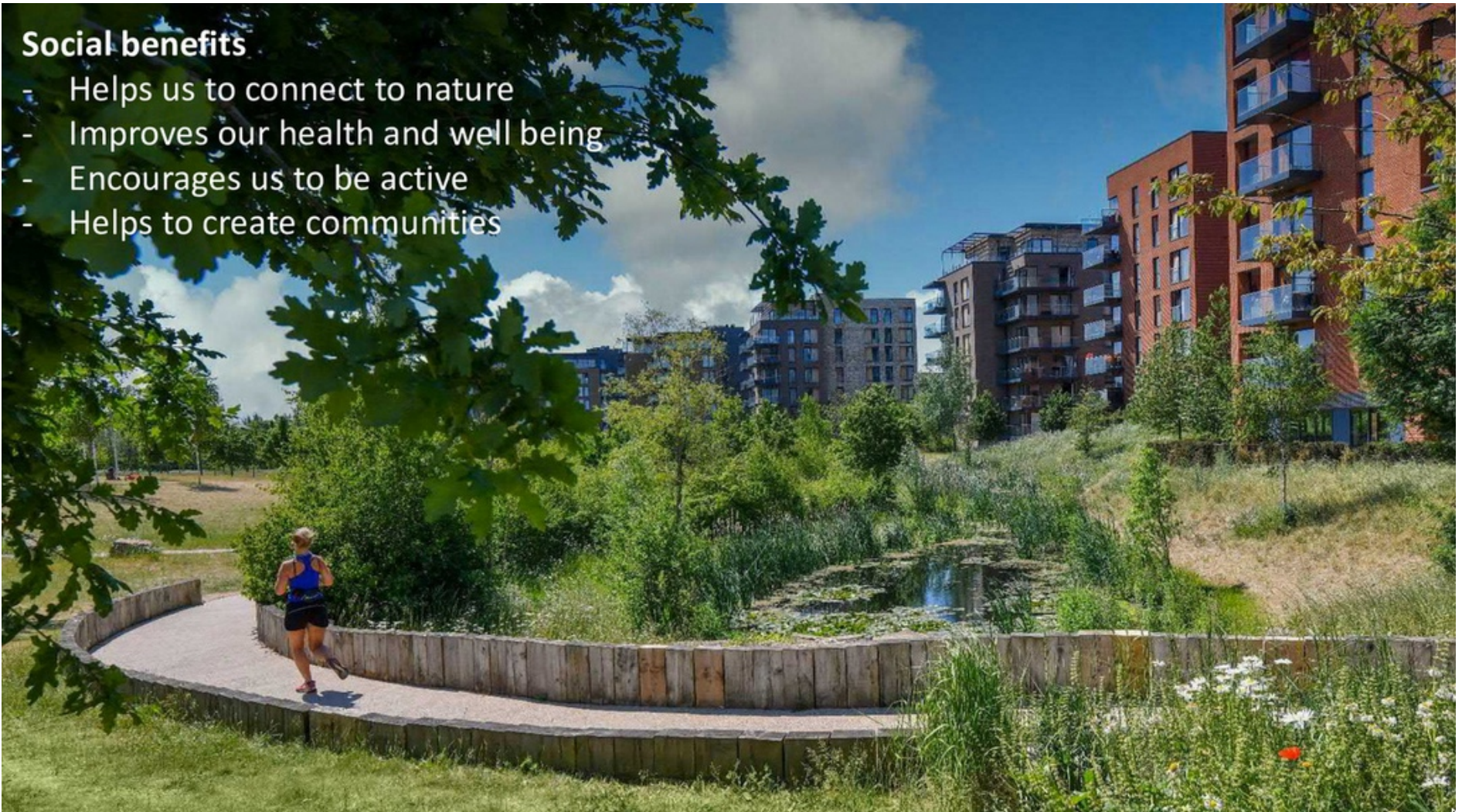
Green walls



Social benefits

Social benefits

- Helps us to connect to nature
- Improves our health and well being
- Encourages us to be active
- Helps to create communities



Other types of greening

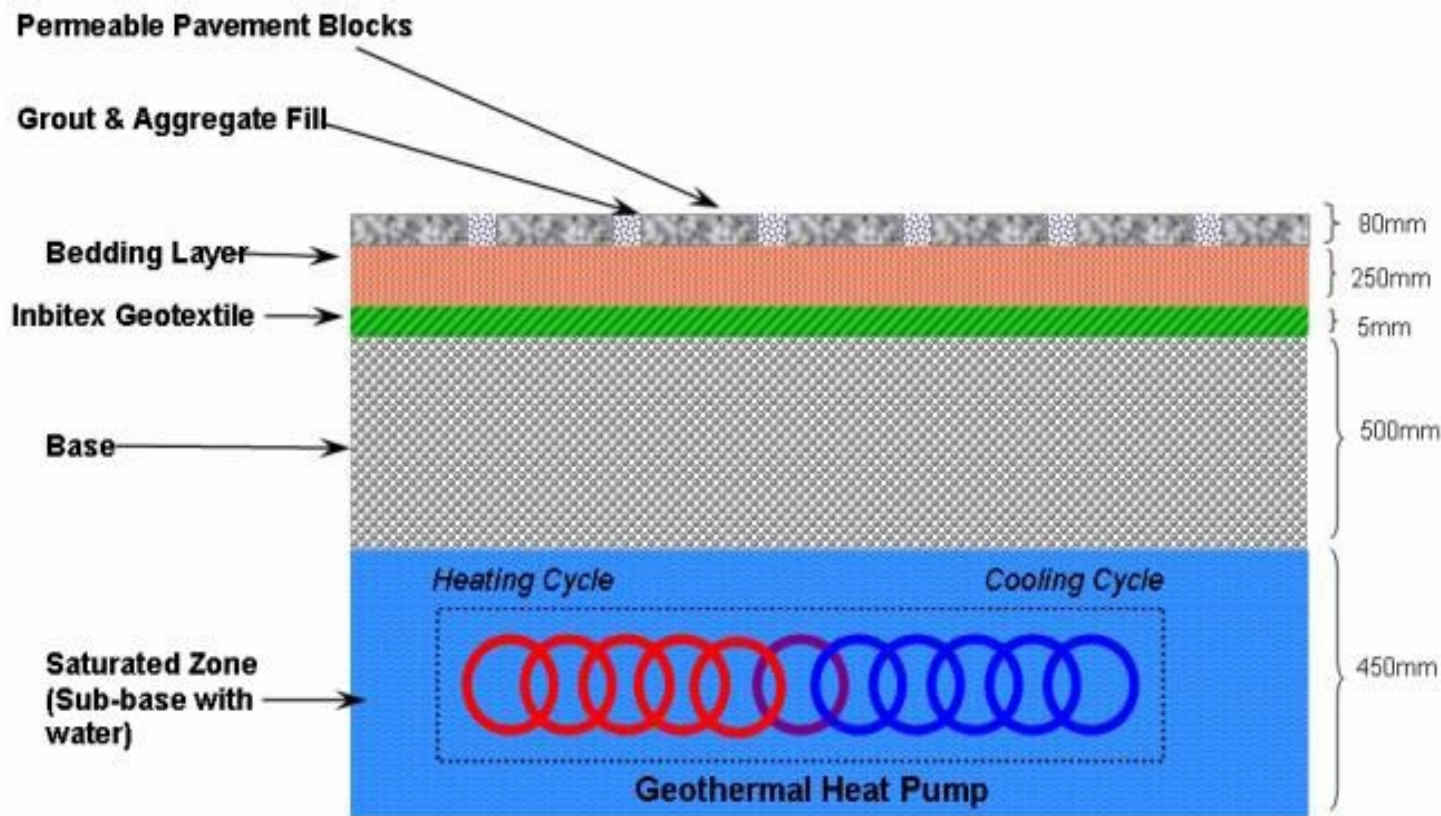


SA1 site



Sustainable Urban Drainage Systems

Integration of Permeable Pavement Systems with Geothermal Heat Pumps

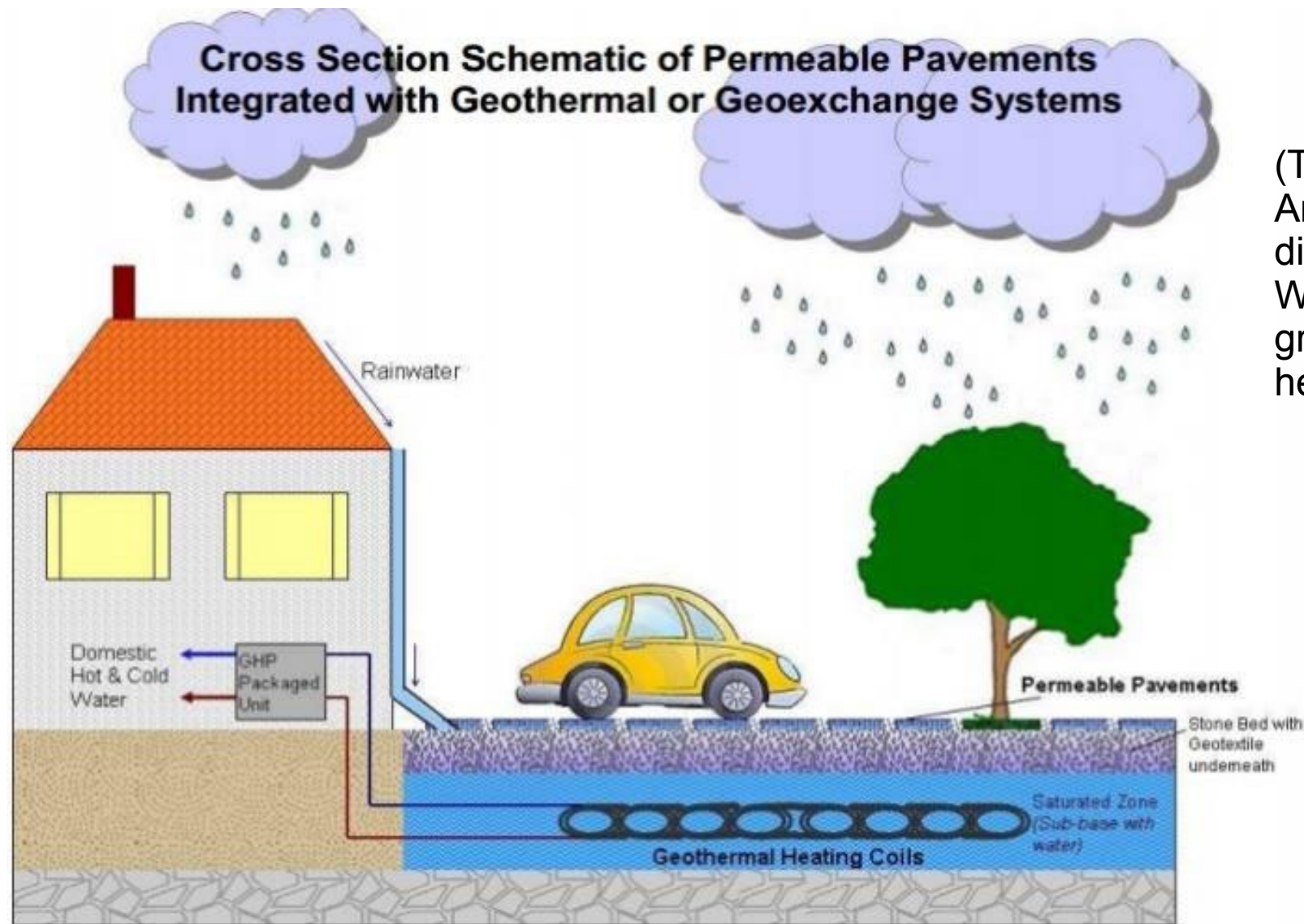


Lattice paving for car parks allowing grass to grow through

Sustainable Urban Drainage Systems



Sustainable Urban Drainage Systems



(This is an American diagram. We call them ground-source heat pumps.)

Coastal protection



Nature-based solutions for reducing wave surges:

- “Sand engine”, Holland
- Kelp forest – full of biodiversity
- Artificial reef construction, Borth, mid-Wales

Coastal protection

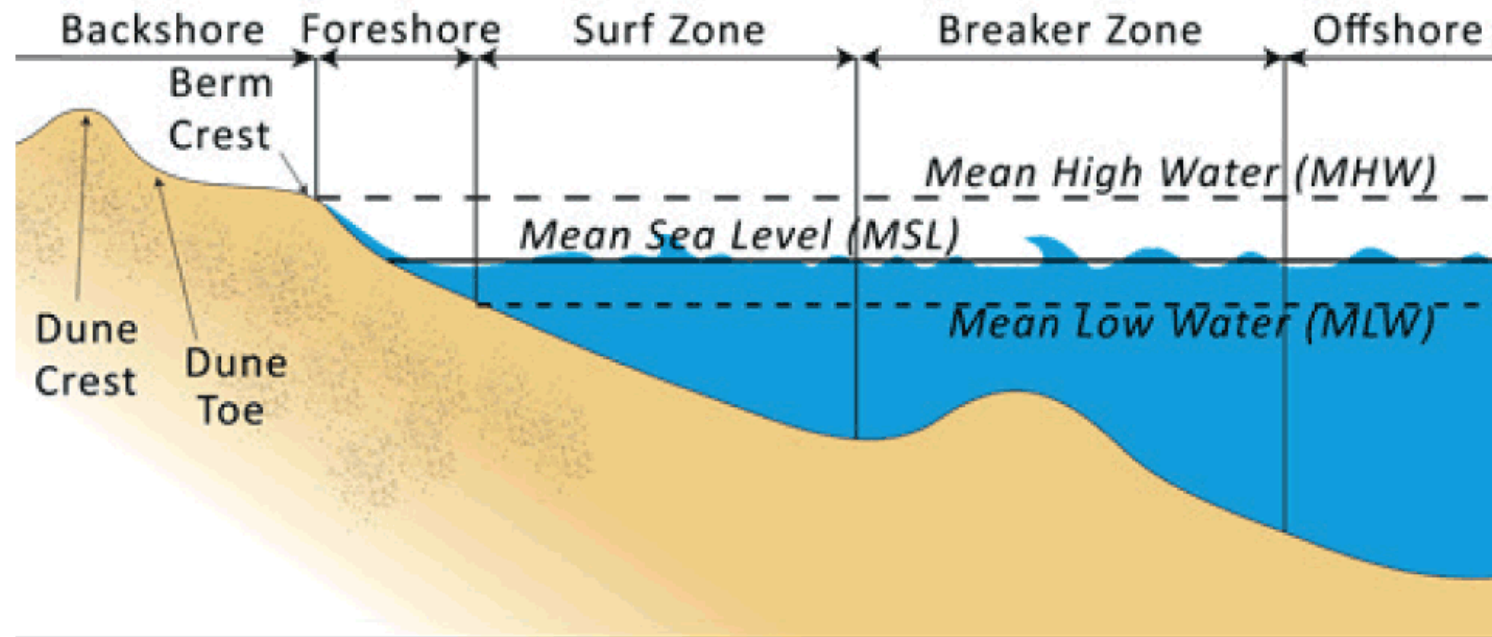


Nature-based solutions for reducing wave surges:

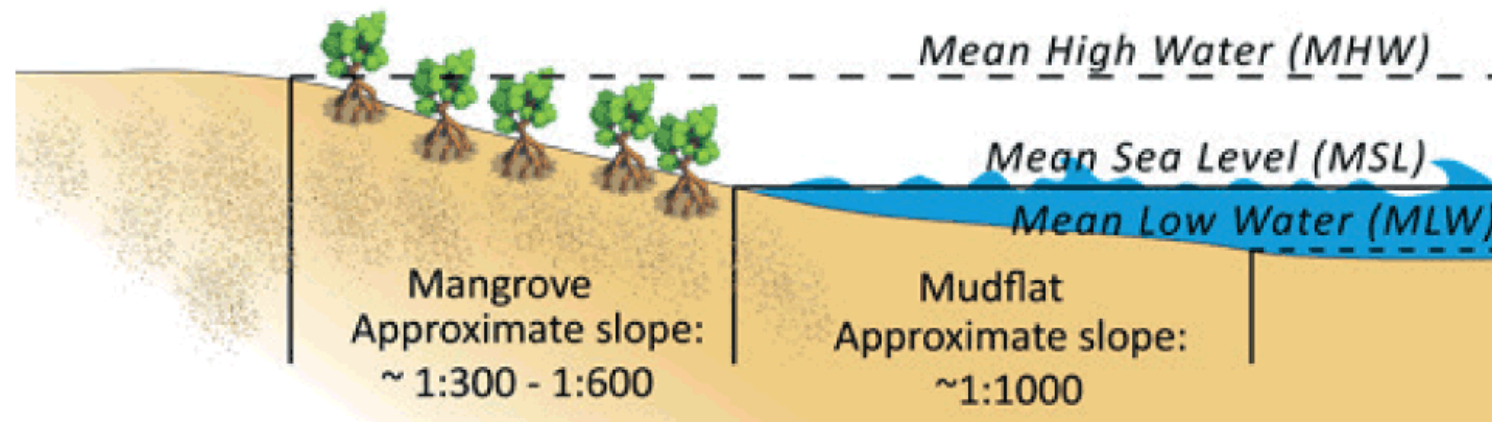
- “Sand engine”, Holland
- Kelp forest – full of biodiversity
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Coastal protection

Sandy Beach System



Mangrove System



Coastal protection

Swansea Vale Flood Storage Area

Completed in 2014, this £6.9 million scheme made space for water by forming new earth embankments creating an area to hold flood water from the River Tawe and its tributaries during flood events. As well as raised embankments the scheme creates more space for water by setting back the flood defences at the top end of the river and taking out three redundant bridges to allow more water to pass.

The NRW scheme has provided wider benefits such as the creation of a natural wetland area which has enhanced 6ha of brownfield industrial land as green space for local people to enjoy and new habitat to support wildlife. 3km of National Cycle Network was upgraded along the river including a new footbridge.



Coastal protection

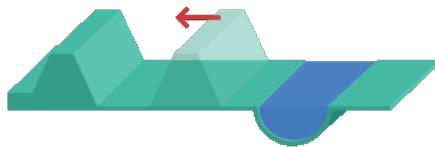
Vertipools, Isle of Wight⁶⁵

Vertipools have been attached to the side of dock in Fishbourne, Isle of Wight in 2017 during an investment project to improve ferry and port facilities.

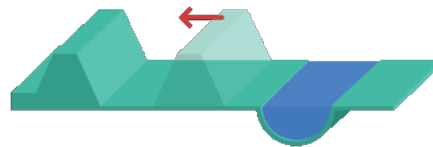


They provide an artificial rock pool which retain water as the tide recedes providing a habitat for fish and invertebrates. Marine life which colonise the pools can also strengthen the integrity of the structure and improve its resilience by providing a covering of organisms such as barnacles, mussels and seaweeds. They are also used for educational purposes allowing local school children on fieldtrips to undertake rock pooling activities and learn about marine biology.

Options for dikes for sea and river flood protection:



Dike relocation



De-poldering



High water channel



Removing obstacles



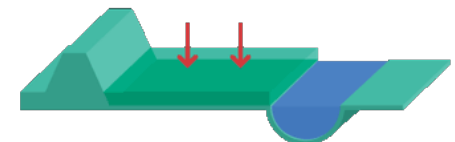
Water retention capacity



Lowering summer bed



Strengthening dikes



Lowering floodplain

Coastal protection



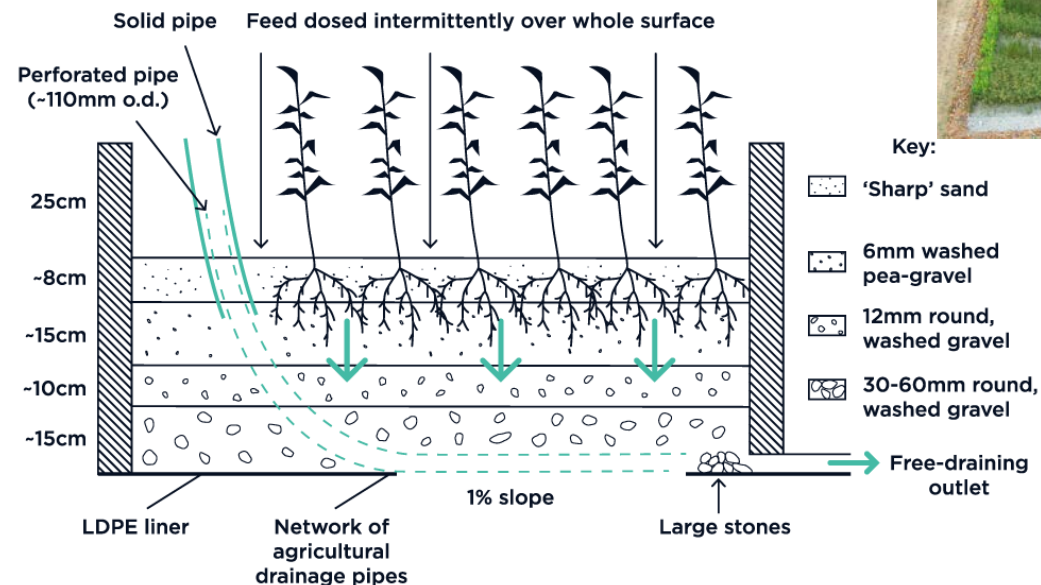
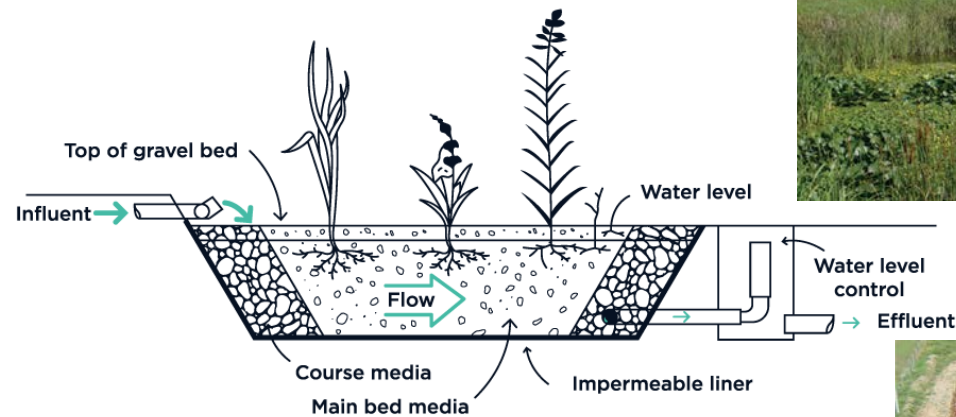
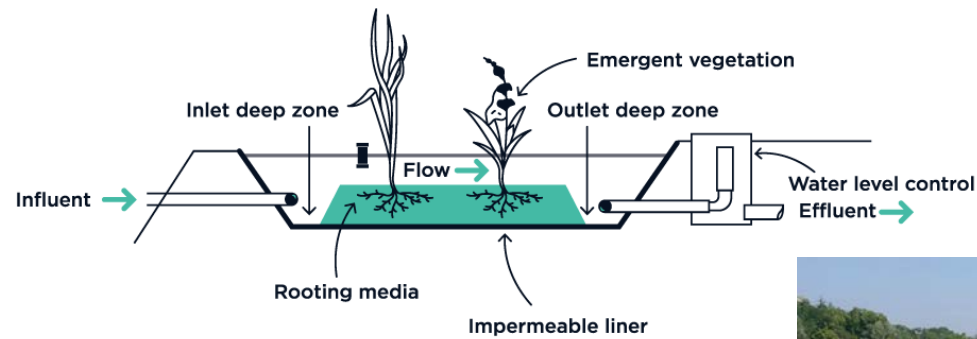
Sometimes you have to pour concrete – but it can be more sustainable (lower embodied carbon) concrete.

New York City's massive multi-billion pound scheme following Hurricane Sandy.

Sewage



Think about
sewage pipes
and treatment.
Can it be done
on site?
Nutrient and
water
reclamation?
Consider
**constructed
wetlands:**



Housing development example

BEAULIEU, CHELMSFORD

A major new district of 3,600 homes for Chelmsford with a draft allocation for a further 3,000 homes in the emerging Local Plan.



3,600 new homes on **610** acres



176 Acres of public open space



New railway station part funded by **£150 m** HIF funding



Major new bypass and A12 junction enhancements



Wide-ranging community facilities



42 acre sports village and **37** acres of open space



667,000 sq ft business park



Major minerals extraction



Multiple sales outlets for product variation



Community centre, neighbourhood centre, and medical centre



Parkland setting for Grade 1 listed New Hall school



Provision of nursery, primary and secondary schools



Placemaking



- A** Flexible indoor/outdoor retail pavilions
- B** Socially distanced al-fresco dining
- C** Cycle route and footfall info accessible via smartphones

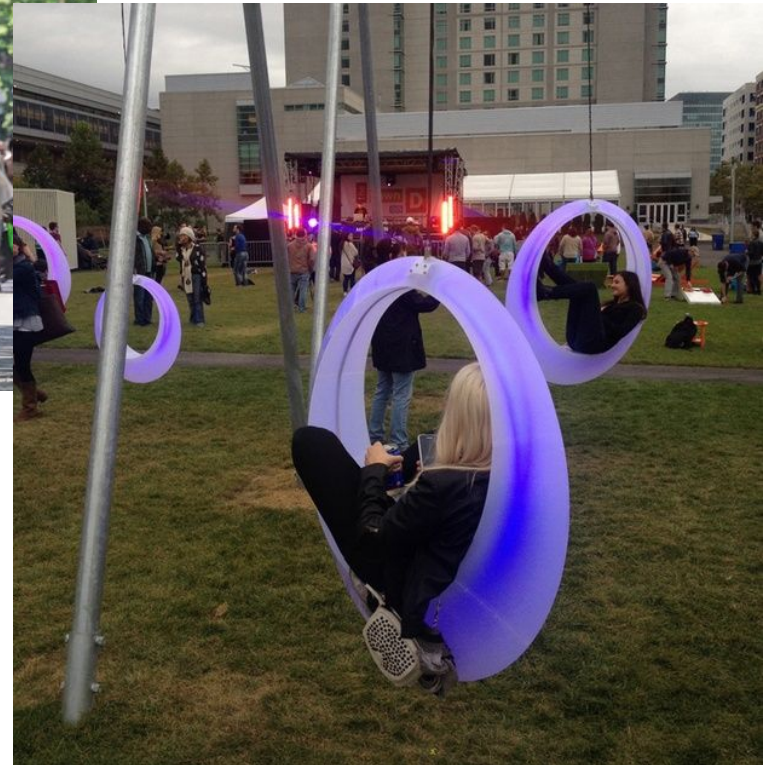
- D** Pop-ups related to commute
- E** Socially distanced outdoor meeting spaces near buildings
- F** Resting areas with foliage



Placemaking



Placemaking

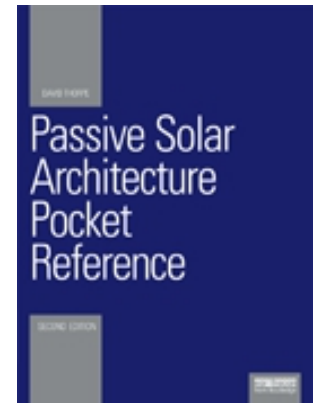
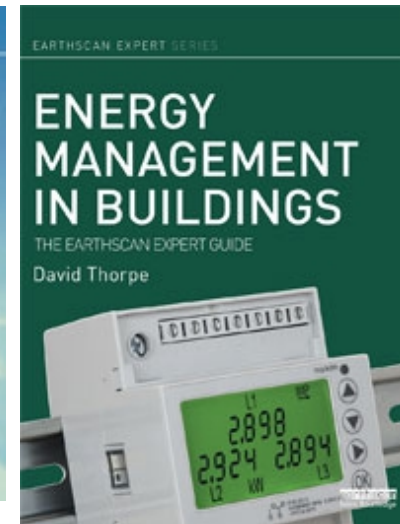
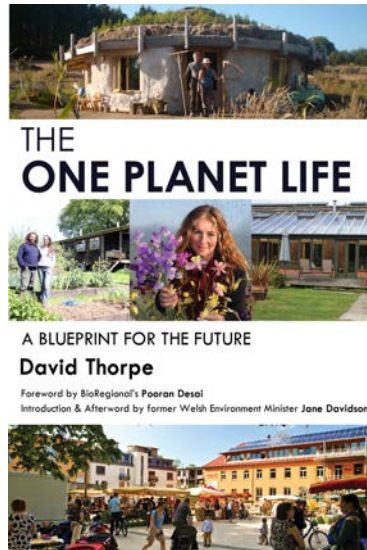
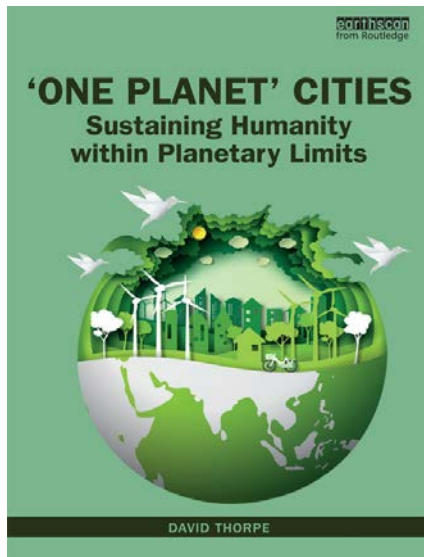
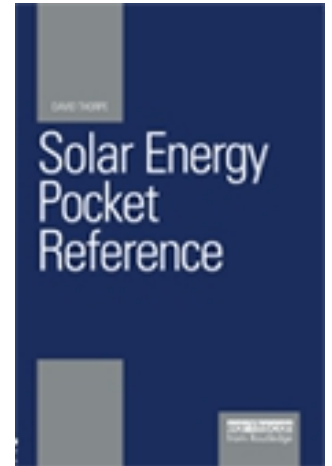


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