Emerging trends in modelling integrated urban water systems

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An Australian Government Initiative

CRC
AUSTRALIA

Integrated Urban Water Management

by managing the urban water cycle as a whole; a more efficient use of resources can be achieved providing not only economic benefits but also improved social and environmental outcomes

Wikipedia

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Water Management in Cities of the Future - A vision for water sensitive cities

Water sensitive cities are resilient, liveable, productive and sustainable.

They: efficiently use the diversity of water resources available within towns and cities; enhance and protect the health of urban waterways and wetlands; and mitigate against flood risk and damage.

They also create public spaces that harvest, clean and recycle water, increase biodiversity and reduce urban heat island effects.

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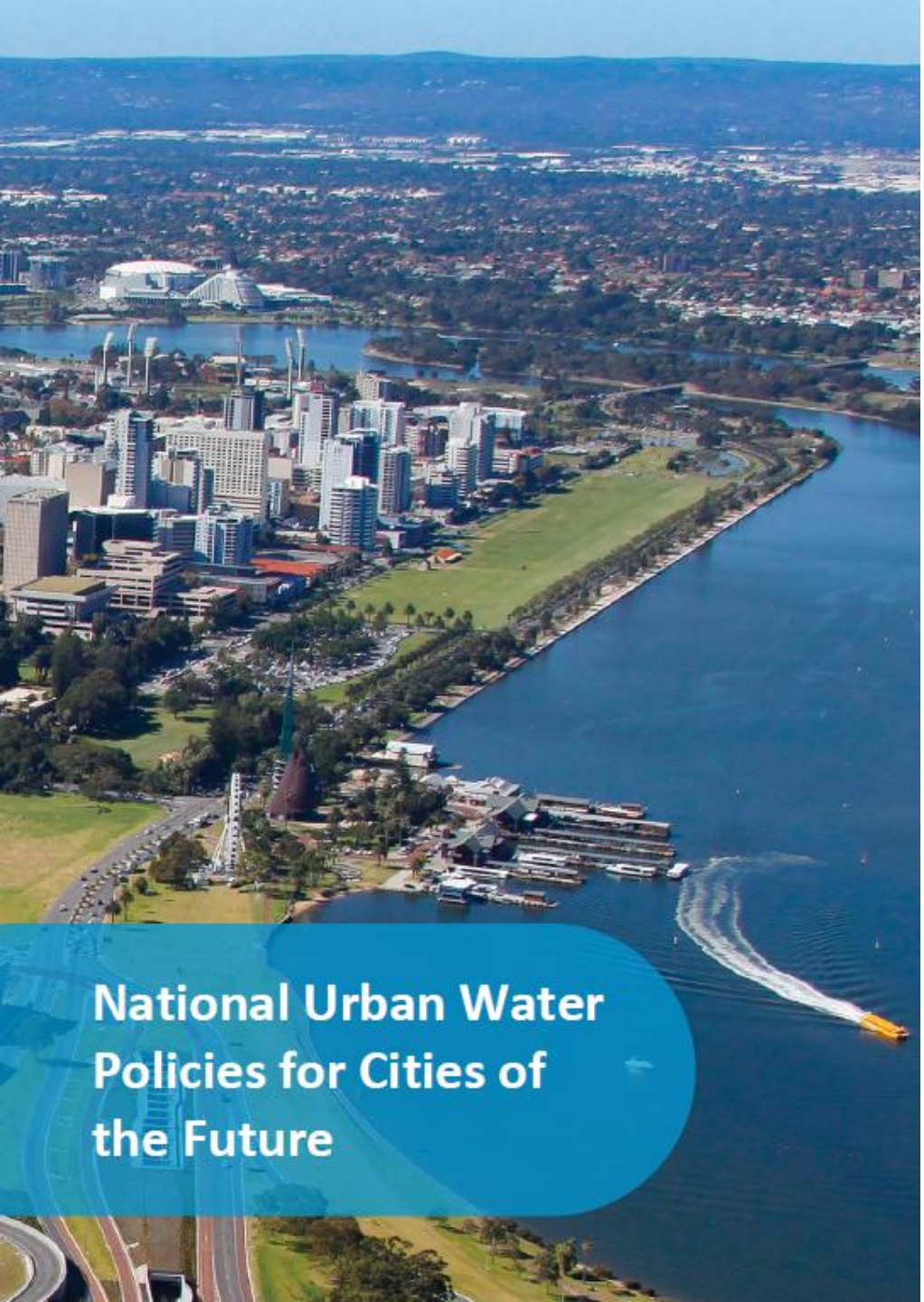

The transformation of urban water systems from a focus on water supply and wastewater disposal (the 'taps and toilets' water utilities) to more complex, flexible systems that:-

- integrate various sources of water;
- operate through a combination of centralised and decentralised systems;
- deliver a wider range of services to communities (e.g. ecosystem services, urban heat mitigation); and
- integrate into urban design.

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Emerging trends in

Integrated Urban Water Management

our ability to incorporate the socio-technical interplay of urban water systems will determine the significance of our traditional modelling capabilities in influencing the transformation of cities into resilient, liveable and sustainable places

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Multiple drivers, Multiple criteria & Multiple scenarios

- The emergence of new performance indices
- Simulating the influence of socio-technical dynamics
- Capturing uncertainties
- Revisiting the concept of optimisation

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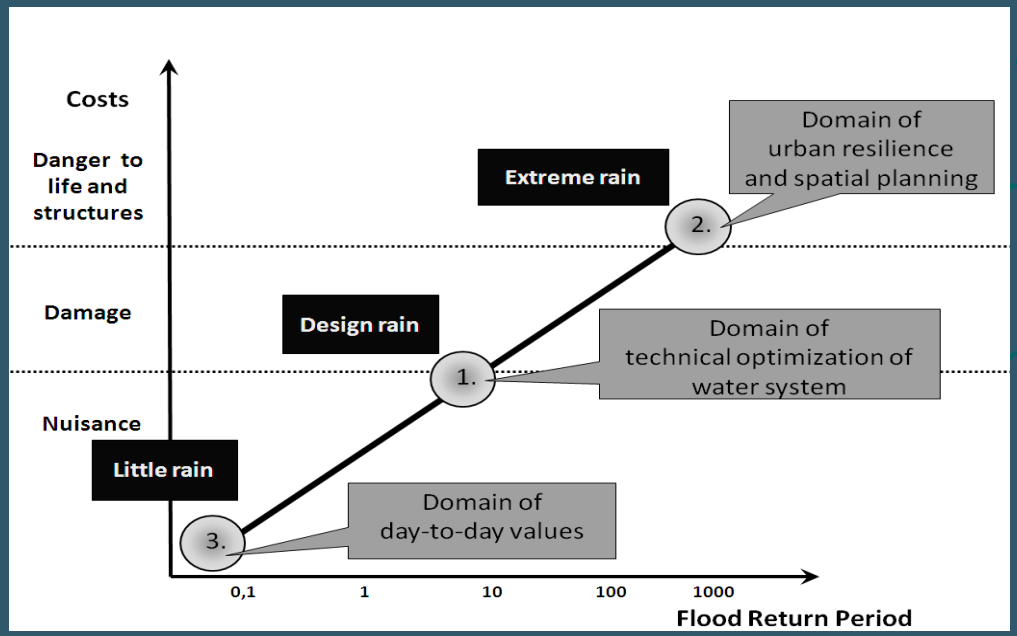

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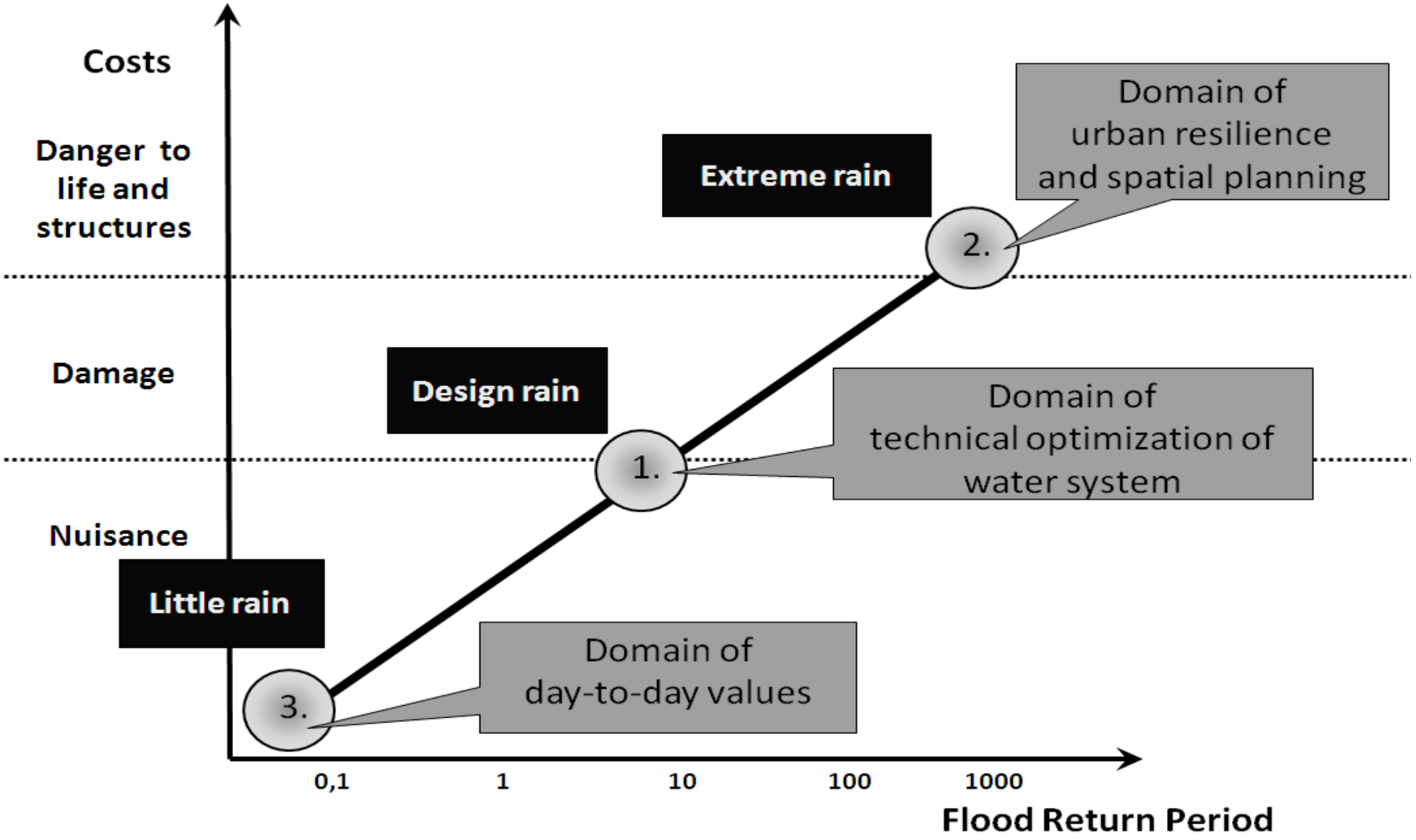

C.F. Fratini, G.D. Geldof, J. Kluck and P.S. Mikkelsen (2012): Three Points Approach (3PA) for urban flood risk management: A tool to support climate change adaptation through transdisciplinarity and multifunctionality. Urban Water Journal. Open Access. DOI:10.1080/1573062X.2012.668913

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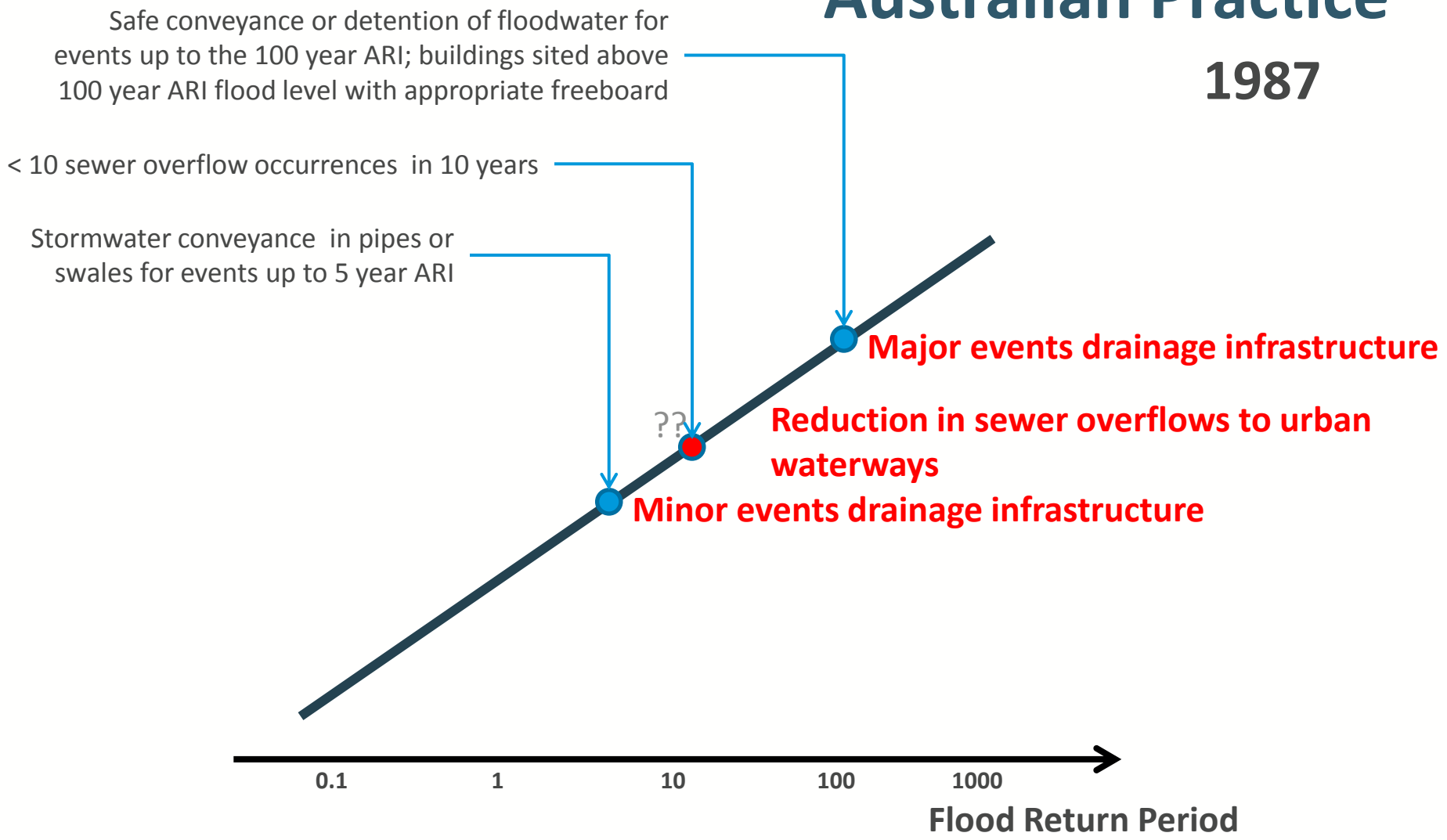
Australian Practice

1987



Institution of Engineers Australia (1987), Australian Rainfall and Runoff: A guide to flood estimation, D H Pilgrim (ed).

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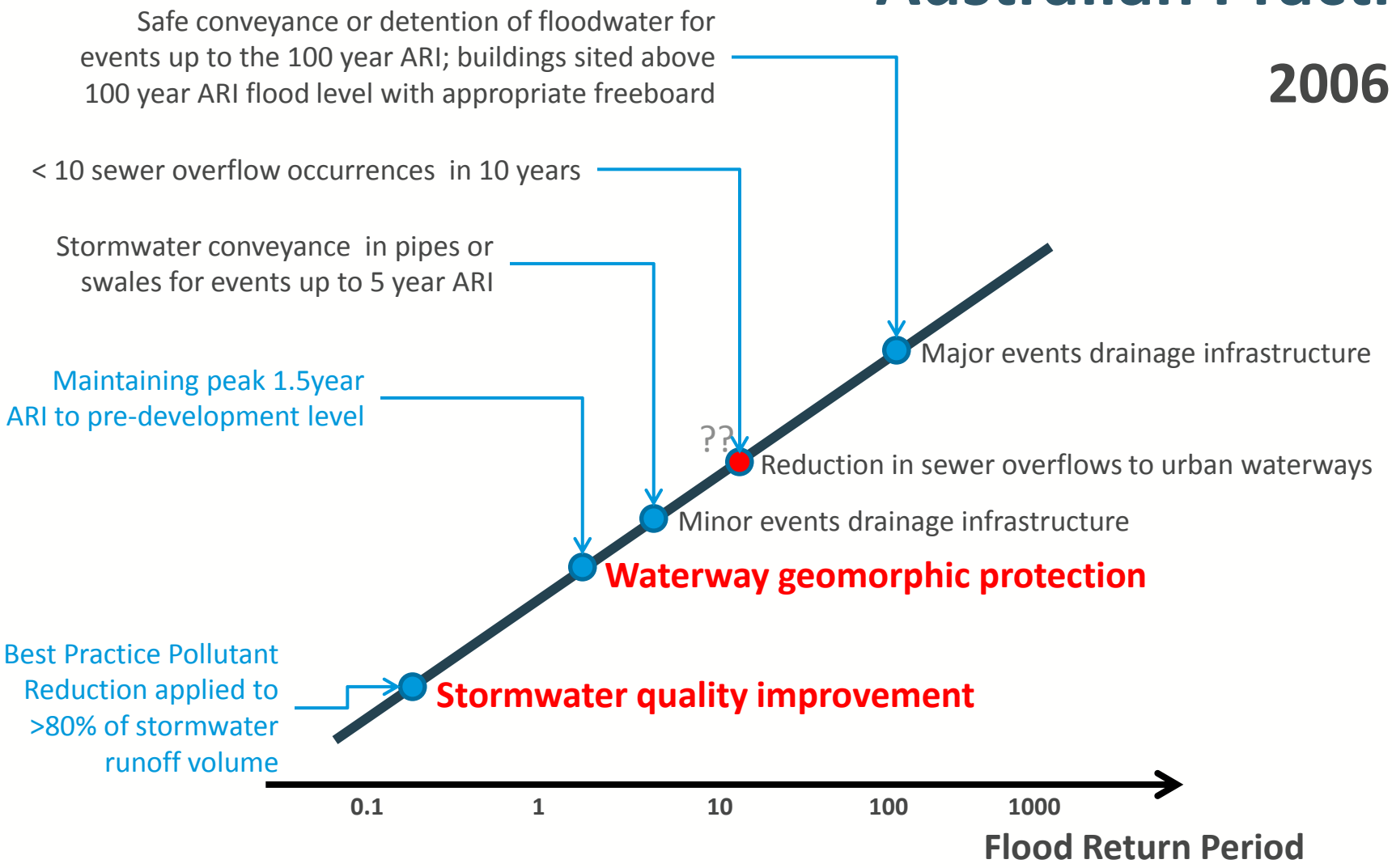
Australian Practice

2006



Victorian Stormwater Committee (2006), Urban Stormwater Best Practice Environmental Management Guidelines, CSIRO Publishing, ISBN 0 643 06453 2, 320p, May 2006.

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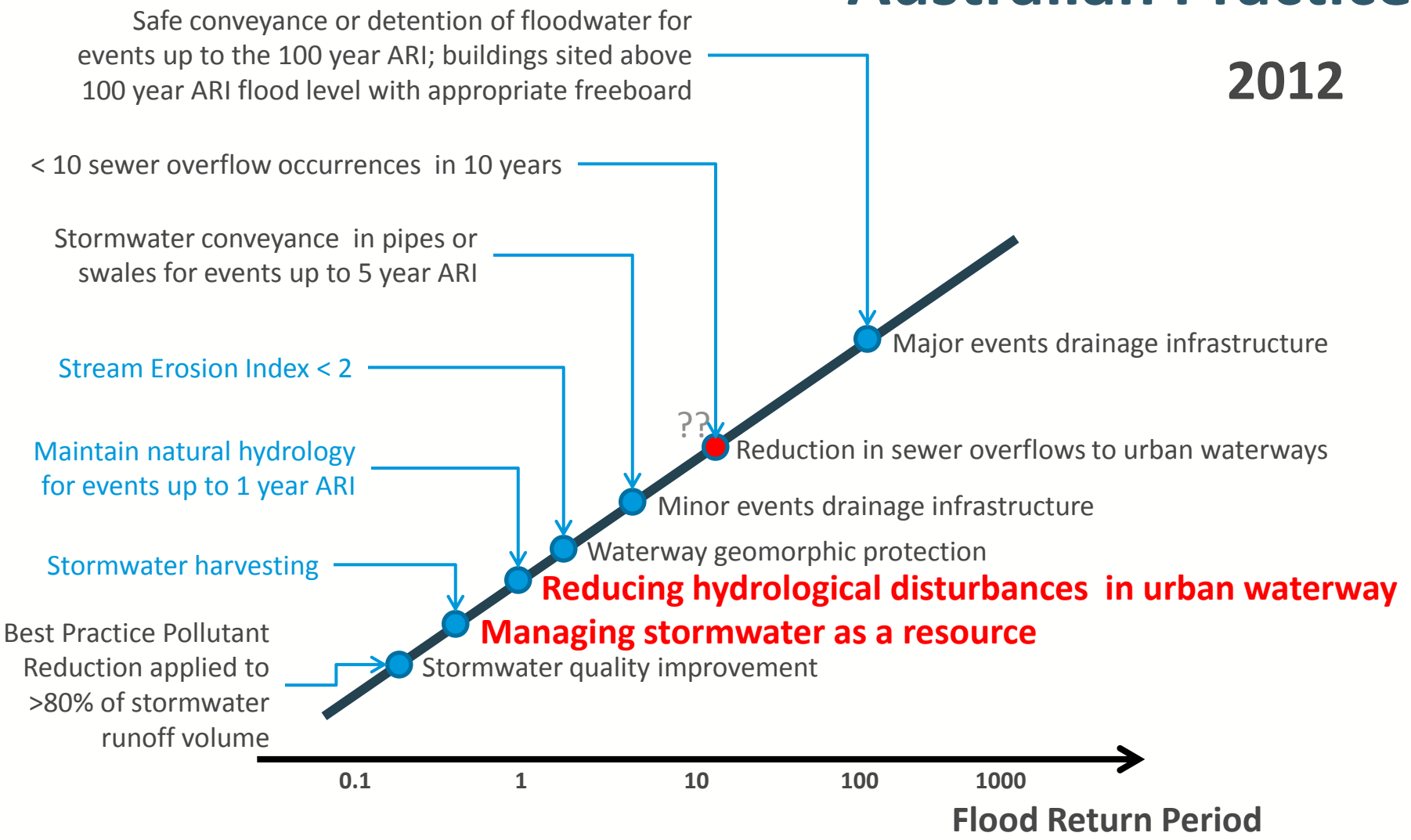
Australian Practice

2012



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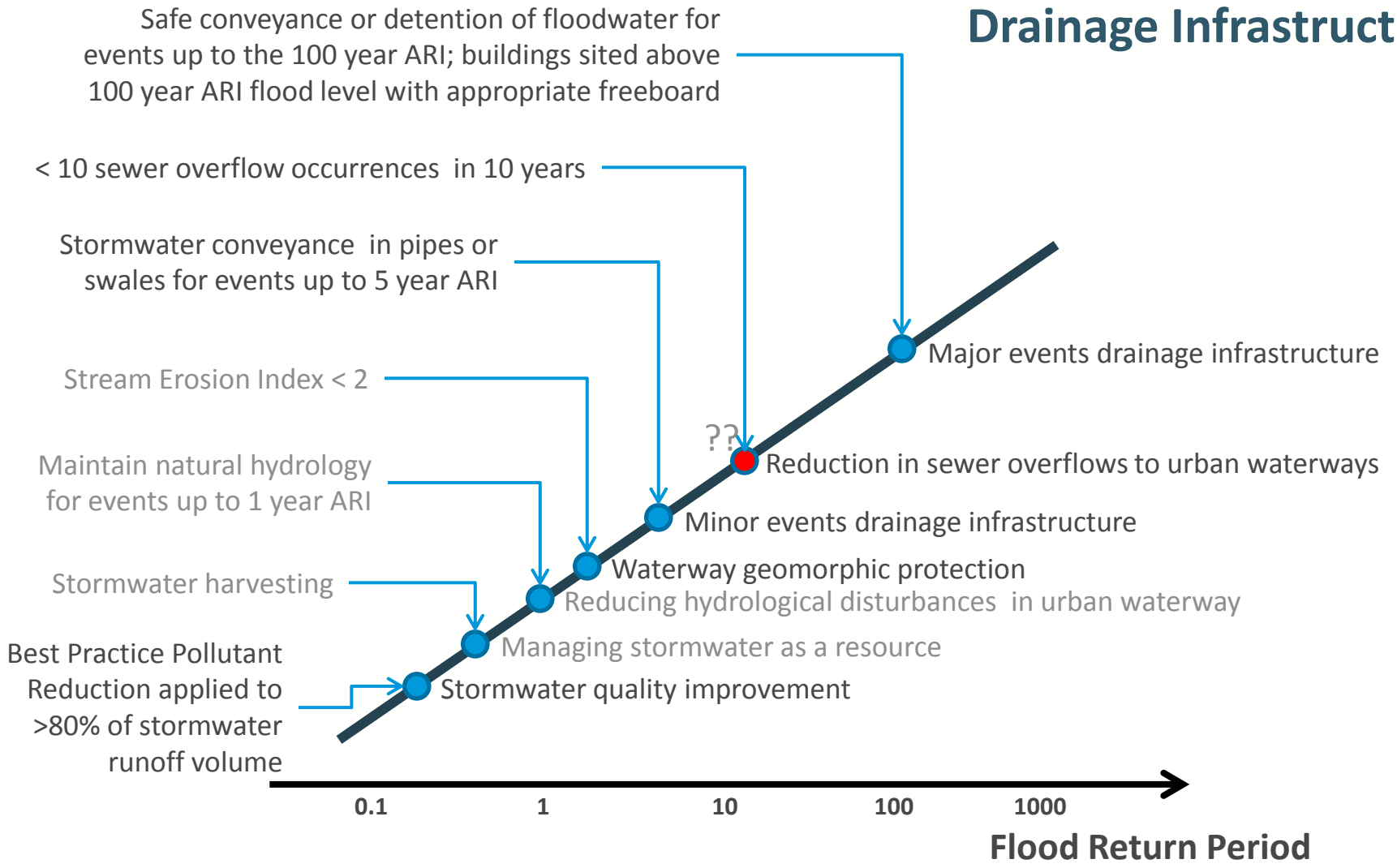
Multiple Hydrologic and Hydraulic Design Objectives for Drainage Infrastructure



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Comfort Capacity

Carrying Capacity

Coping Capacity

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Linking Urban Water Management and Urban Liveability

Johnstone, P., Adamowicz, R., de Haan, F., Ferguson, B. and Wong, T. (2012), Liveability and the Water Sensitive City, Monash University, ISBN 978-1-921912-12-2, July 2012

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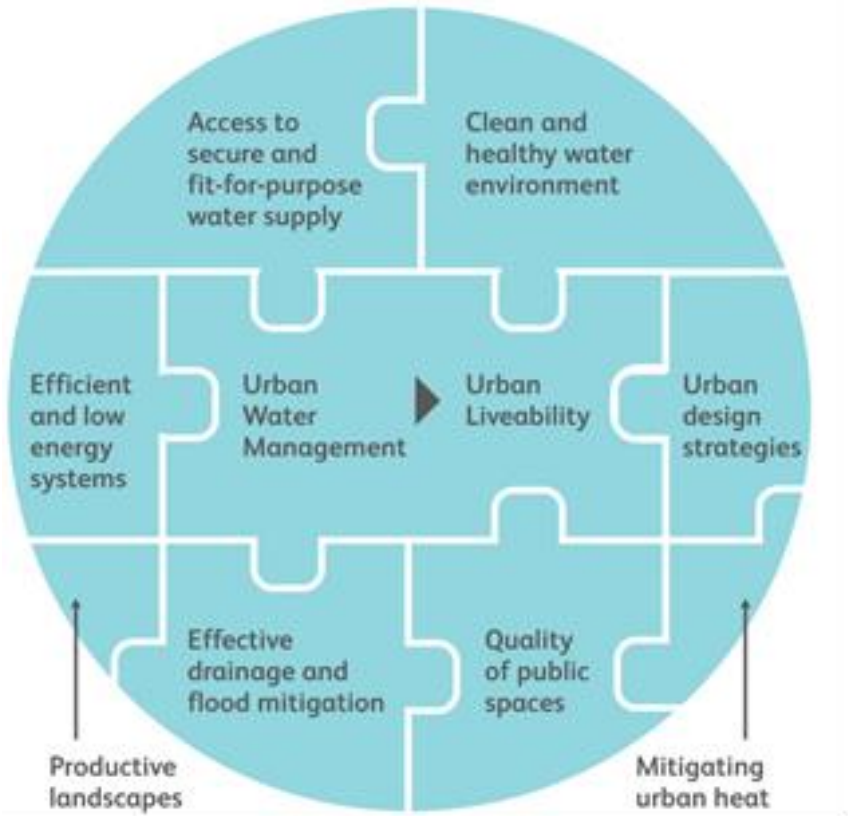
Figure 5: Linking Urban Water Management to Urban Liveability[12]



Linking Urban Water Management and Urban Liveability

Wong, T., Allen, R., Brown, R., Deletic, A., Griggs, D., Hodyl, L., McIlrath, B., Montebello, T., Smith, L. (2011), Transitioning to a resilient, liveable and sustainable greater Melbourne (localised case studies), report prepared for the Living Victoria Ministerial Advisory Council, March 2011

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Effective Drainage & Flood Mitigation

- Future cities would incorporate into its **urban planning and design of appropriate land uses in accordance to the three-tiered approach of retreat, adapt and defend** against future flood vulnerability.

- A water sensitive city would establish **a network of blue and green open spaces and corridors to serve as an integral element of the city's drainage infrastructure** and floodway for flood conveyance during rare (low probability) storm occurrences.

Urban design strategy

- Parklands, green waterways, structures and buildings are '**green infrastructure**' that emphasise the important role that vegetation (and therefore water and irrigation) plays in urban environments.

- Access to alternative **fit-for-purpose water sources provides an additional and abundant source of water to allow the greening of cities**.

The quality of public spaces

- Urban water systems designed in urban environments to **incorporate means of enhancing social engagement and cultural expression**

- Public spaces to include the **celebration of water** in urban environments with art features that respond to water availability and seasonality, and the establishment of biodiversity terrestrial and aquatic corridors.



Mitigating urban heat

- **Climate responsive designs** will have a positive effect on human health. Urban heat mitigating design responses should place particular emphasis on the strategic implementation of WSUD technologies and green infrastructure.

- Green infrastructure supported by such **design principles of keeping water in the landscapes and promoting lush and well-irrigated vegetation** can provide microclimate benefits by reducing excess urban heating (through shading, and cooling by evapotranspiration) and limit human exposure to extreme heat.



Multiple drivers, Multiple criteria & Multiple scenarios

- The emergence of new performance indices
- Simulating the influence of socio-technical dynamics
- Capturing uncertainties
- Developing strategies for implementation

Stormwater runoff is generated across distributed areas and therefore presents the best opportunity for green infrastructure be distributed throughout the urban area for effective realisation of multiple benefit outcomes

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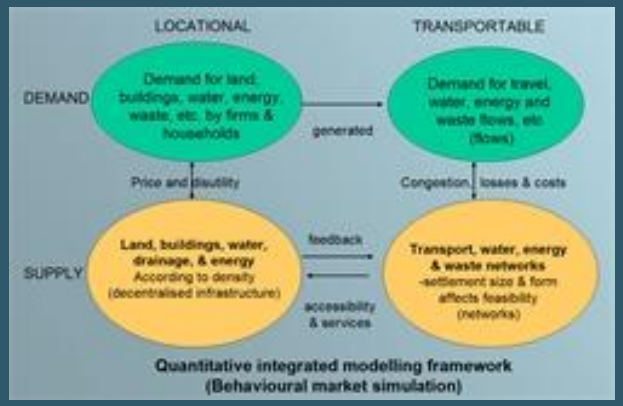
Multiple drivers, Multiple criteria & Multiple scenarios

ReVISIONS

Regional Visions of Integrated Sustainable Infrastructure Optimised for Neighbourhoods



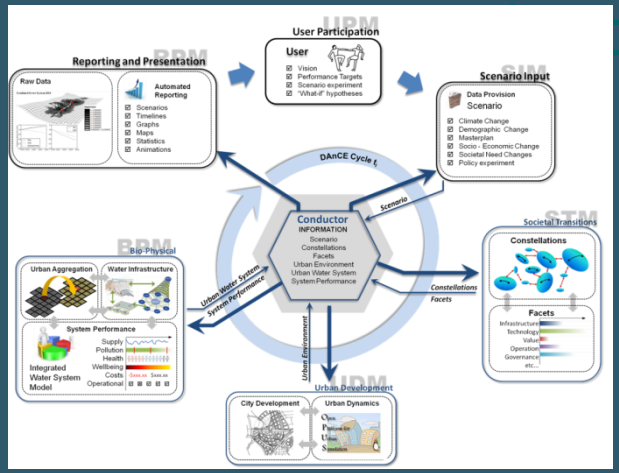
CORFU

FP7 Collaborative research on flood resilience in urban areas

- The emergence of new performance indices
- Simulating the influence of socio-technical dynamics
- Quantifying uncertainties
- Operationalising the concept of

DAnCE4Water

Dynamic Adaptation for enabling City Evolution for Water



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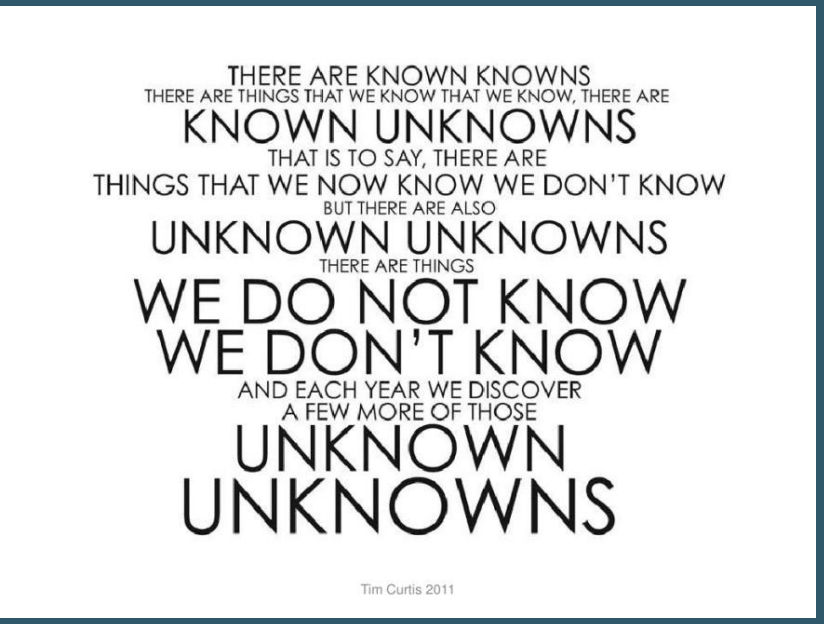

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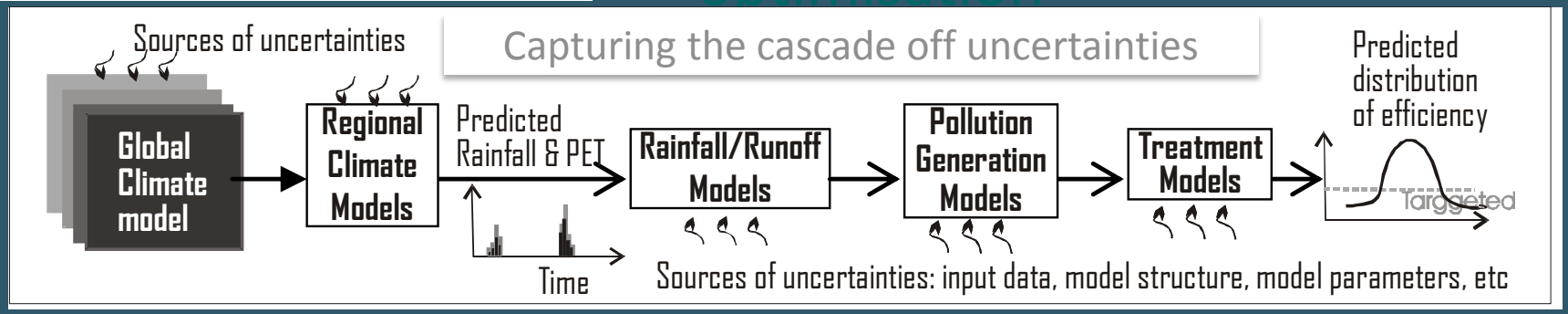

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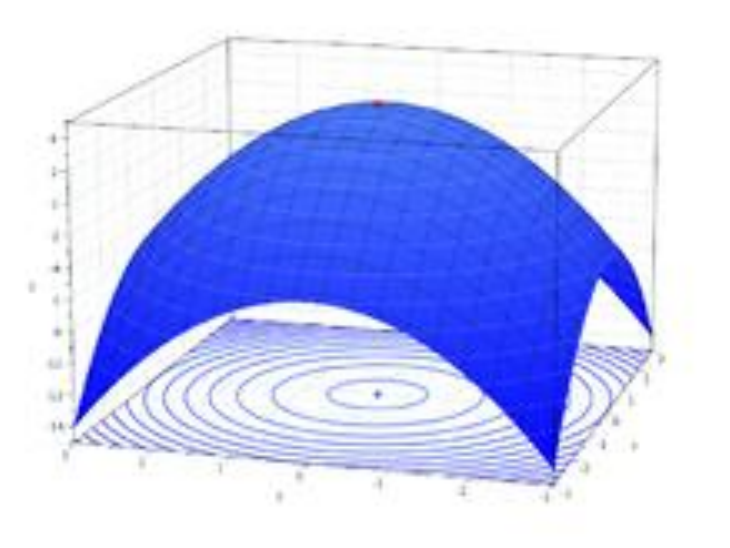

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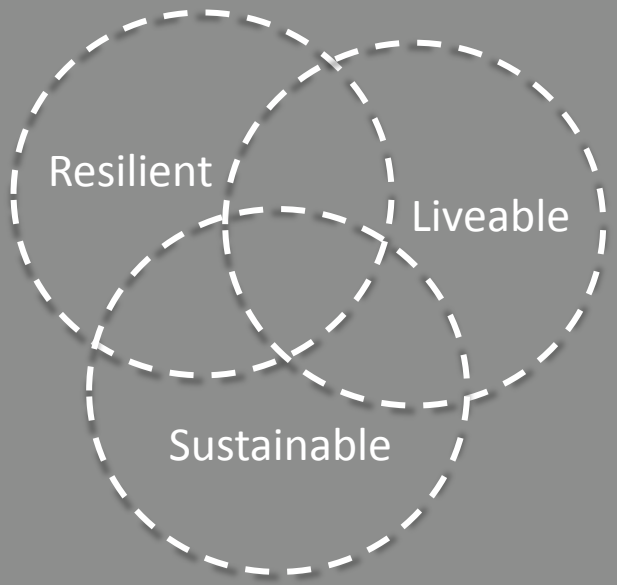
conclusions

Integrated urban water management

- the emergence of hybrid centralised/decentralised infrastructure and green infrastructure
- water management for multiple benefits that include enhancing urban liveability
- solutions are distributed throughout the urban area for effective realisation of multiple benefit outcomes
- strategies need to be adaptive to the socio-technical dynamics of urban growth, expanding integration and changing priorities of management objectives

conclusions



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