Water sensitive cities

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UCT Summer School
Course 1003 – Water sensitive cities: Prospects for Cape Town
Lecture 1: Water sensitive cities
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The way we manage urban water influences almost every aspect of our urban environment and quality of life

Tony Wong

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https://watersensitivecities.org.au/

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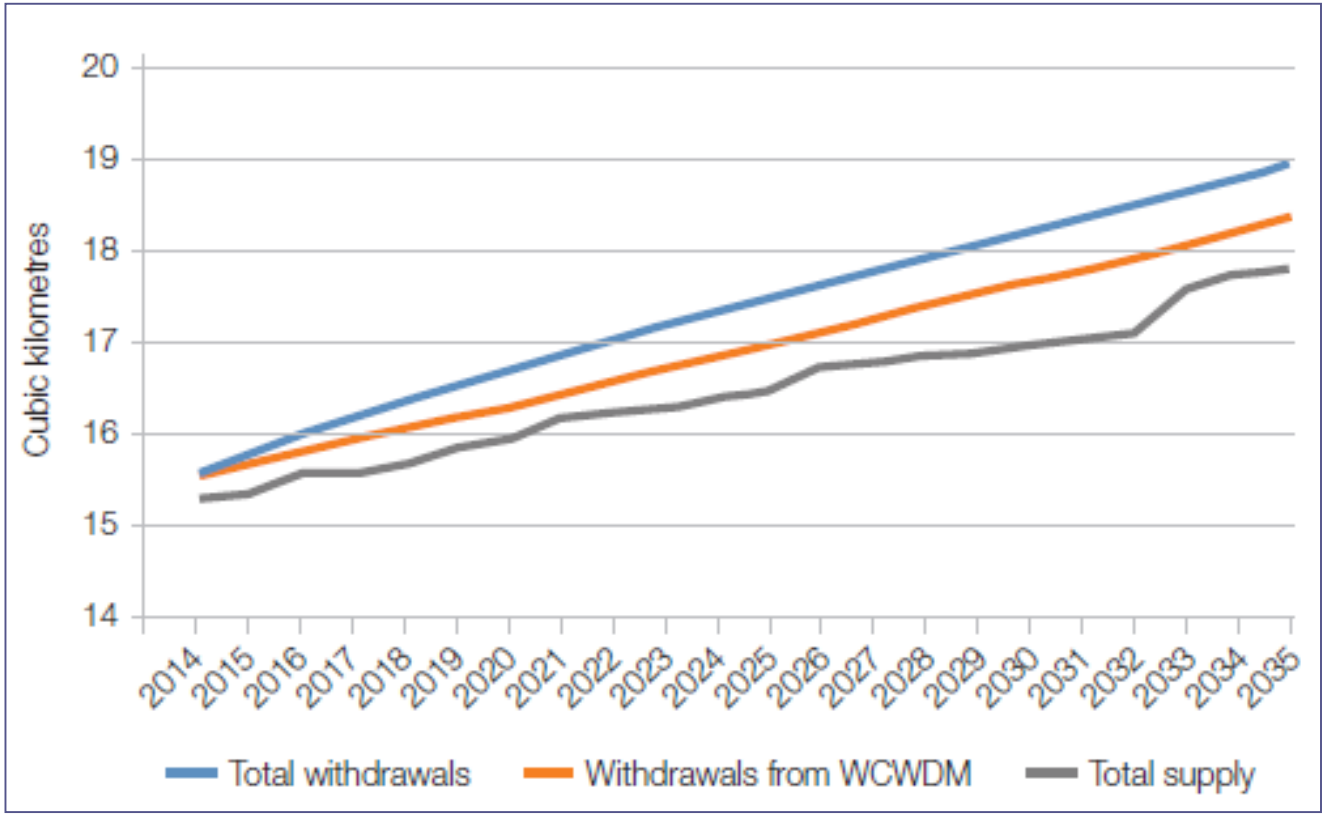
SA's water 'crisis' - "*too much, too little, too dirty*"

- Low rainfall / high evaporation
- Urbanisation
- Population growth
- Services backlogs
- Poor water quality
- Leakage / wastage
- Fragmented institutions
- Quality of life
- Poverty / inequality



(Source: Hedden, 2016)

…the availability of water of acceptable quality is predicted to be the single greatest and most urgent development constraint facing South Africa" (*Scholes, 2001)*

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Meanwhile in Cape Town

DAY ZERO 22 | 04 | 2018

THE DAY THE TAPS WILL BE TURNED OFF

Day Zero is based on the previous week's daily consumption average of 559 Ml/day. Only if all Capetonians reduce their daily use down to 87 litres or less, and the City implements the necessary projects, will we avoid Day Zero. To find out what you can do, visit www.capetown.gov.za/thinkwater

THE CITY

The City's progress on securing alternative water sources.

50%

Cape Town Harbour (Desalination)	50%
Strandfontein (Desalination)	52%
Monwabisi (Desalination)	58%
V&A Waterfront (Desalination)	33%
Cape Flats (Ground Water)	53%
Atlantis (Ground Water)	60%

THE DAMS

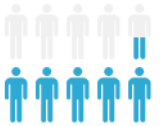
Combined level of dams supplying the city. For more info click here.

29.7%

WEEKLY TREND - 1.3%

CAPETONIANS

Percentage of residents using 87l or less per day.

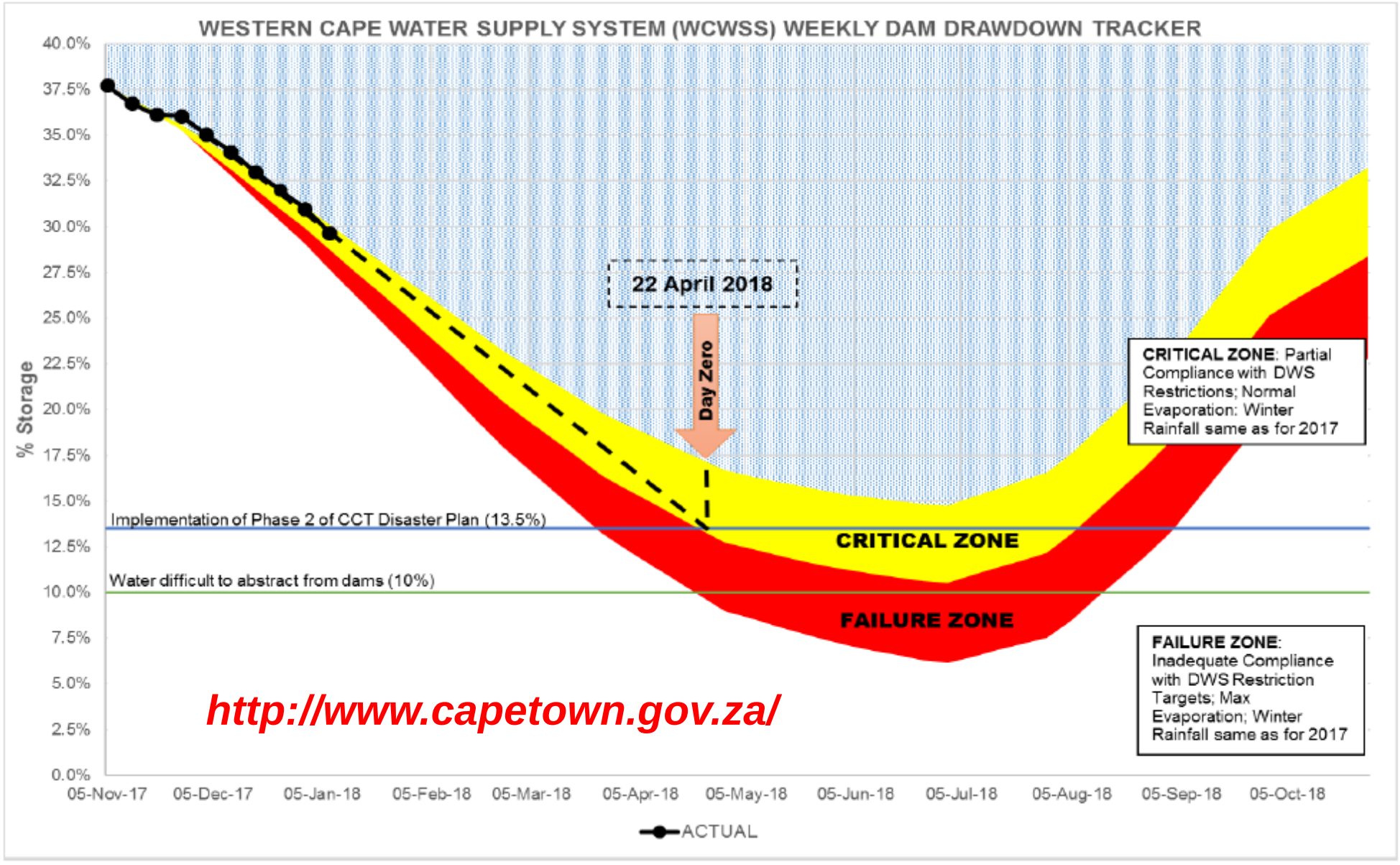


54%

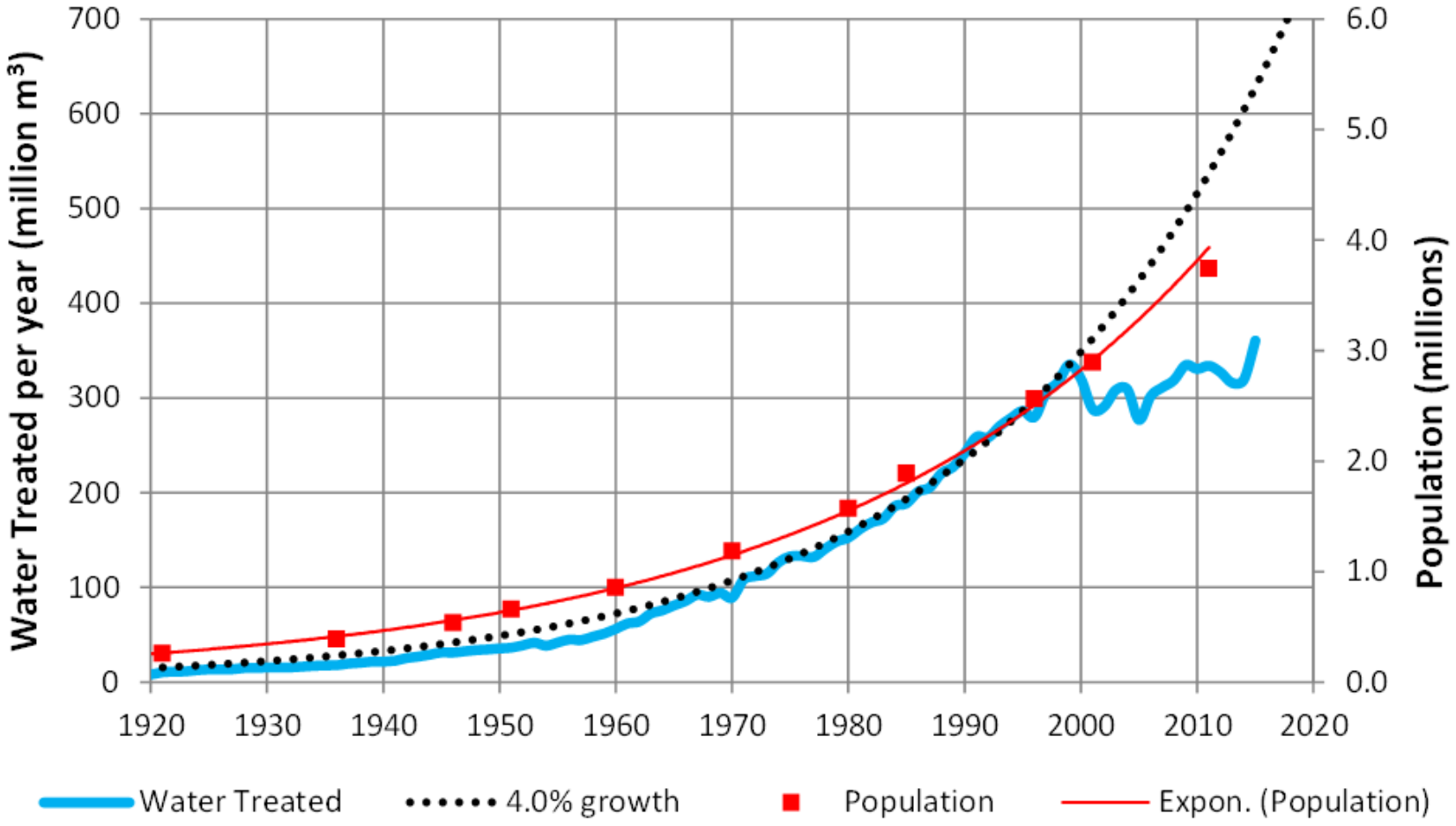
WEEKLY TREND - 20%

TOGETHER, WE CAN AVOID DAY ZERO

WCWSS weekly dam drawdown tracker



CT water demand and pop. growth 1920-2015



Source: CCT, 2015; Singles, n.d.; StatsSA, n.d.

Cape Town annual rainfall 1977 - 2017

"Blame game won't solve Cape Town's crisis"

Dr Rolfe Eberhard

Business Live, 9 January 2018

https://www.businesslive.co.za/bd/opinion/2018-01-09-blame-game-wont-solve-cape-towns-water-crisis/

http://www.csag.uct.ac.za/current-seasons-rainfall-in-cape-town/

‘Future proofing’ cities (Wong, 2012)

- Resilient (coping capacity), liveable (comfort capacity) and sustainable (carrying capacity) cities
- Blue / green corridors integral elements of city’s drainage infrastructure for flood conveyance
- Influence of socio-technical dynamics
- Managing stormwater as a resource
- Enhancing water-energy-waste nexus
- Multi-functional infrastructure - hybrid between centralised and decentralised; meet basic needs, enhance aspirational needs

Design principle – “keep water in the town / city”

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Water Sensitive Design

"In its broadest context, WSD encompasses all aspects of integrated urban water cycle management, including water supply, sewerage and stormwater management. It represents a significant shift in the way water and related environmental resources and water infrastructure are considered in the planning and design of cities and towns, at all scales and densities" (Fletcher *et al.*, 2014)

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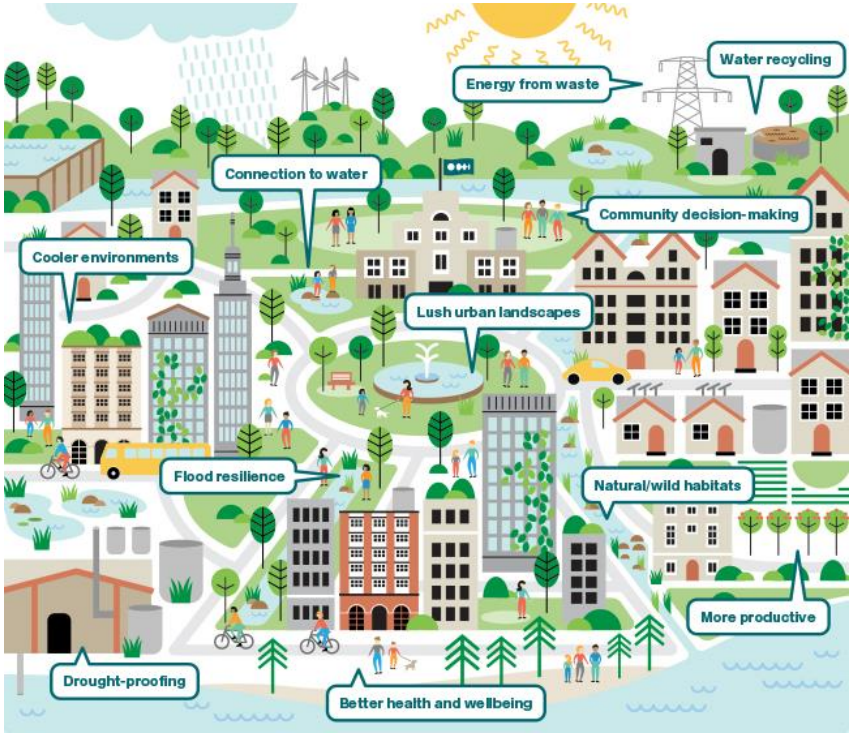
Water sensitive cities



1. Sustainable water supply options
   - Water Conservation / Demand Management
   - Alternative water sources
2. Stormwater management
   - Sustainable Drainage Systems (SuDS)
   - Enhancement of amenity and biodiversity
3. Wastewater minimisation
   - Water recycling
   - Use of treated wastewater / resource recovery
   - Quality improvement – ‘fitness for purpose’
4. Design and planning
   - Enhancing liveability
   - Providing resilience

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What can WSD help with?

- Building flexibility & adaptability into water sources - including *"Cities as Water Supply Catchments"*
- Building flexibility & adaptability into sanitation ensuring healthy cities
- Blue-Green Infrastructure, *"Cities providing ecosystem services"*
- Building social and institutional capital, "*Cities supporting water-educated communities*"

Sophisticated, *equitable* and Water Smart City

Better urban water management provides the core for multi-value multifunctional urban spaces that are fit to cope with future challenges

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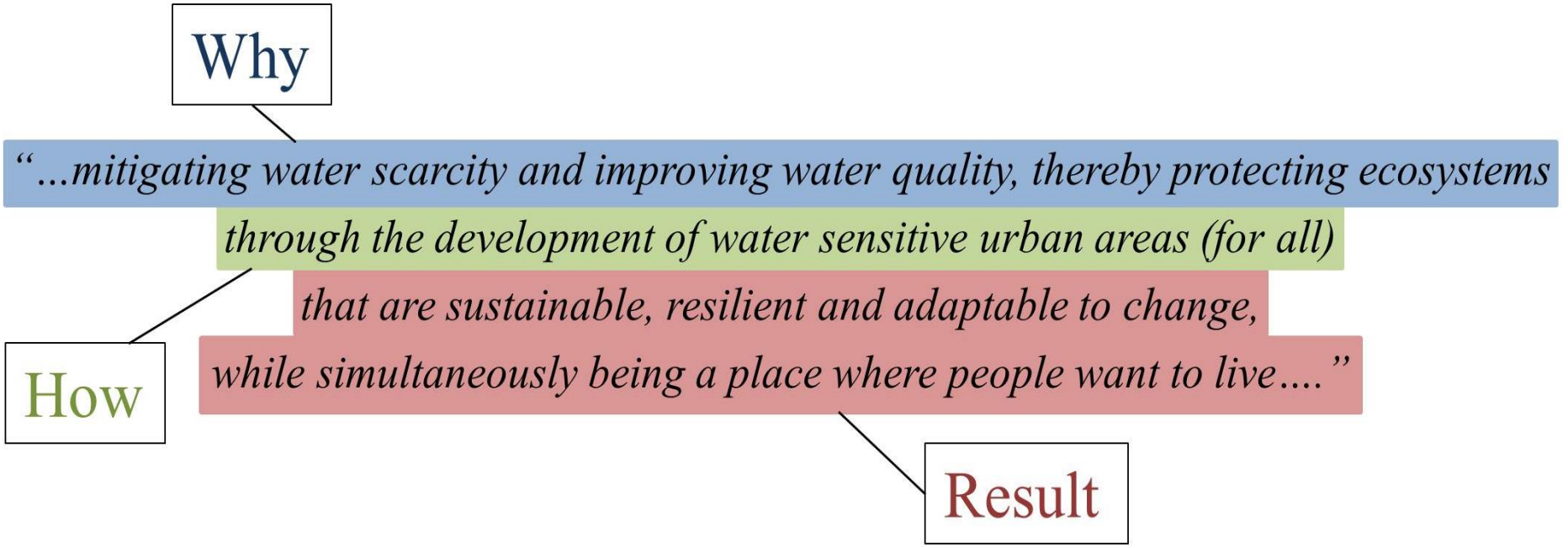
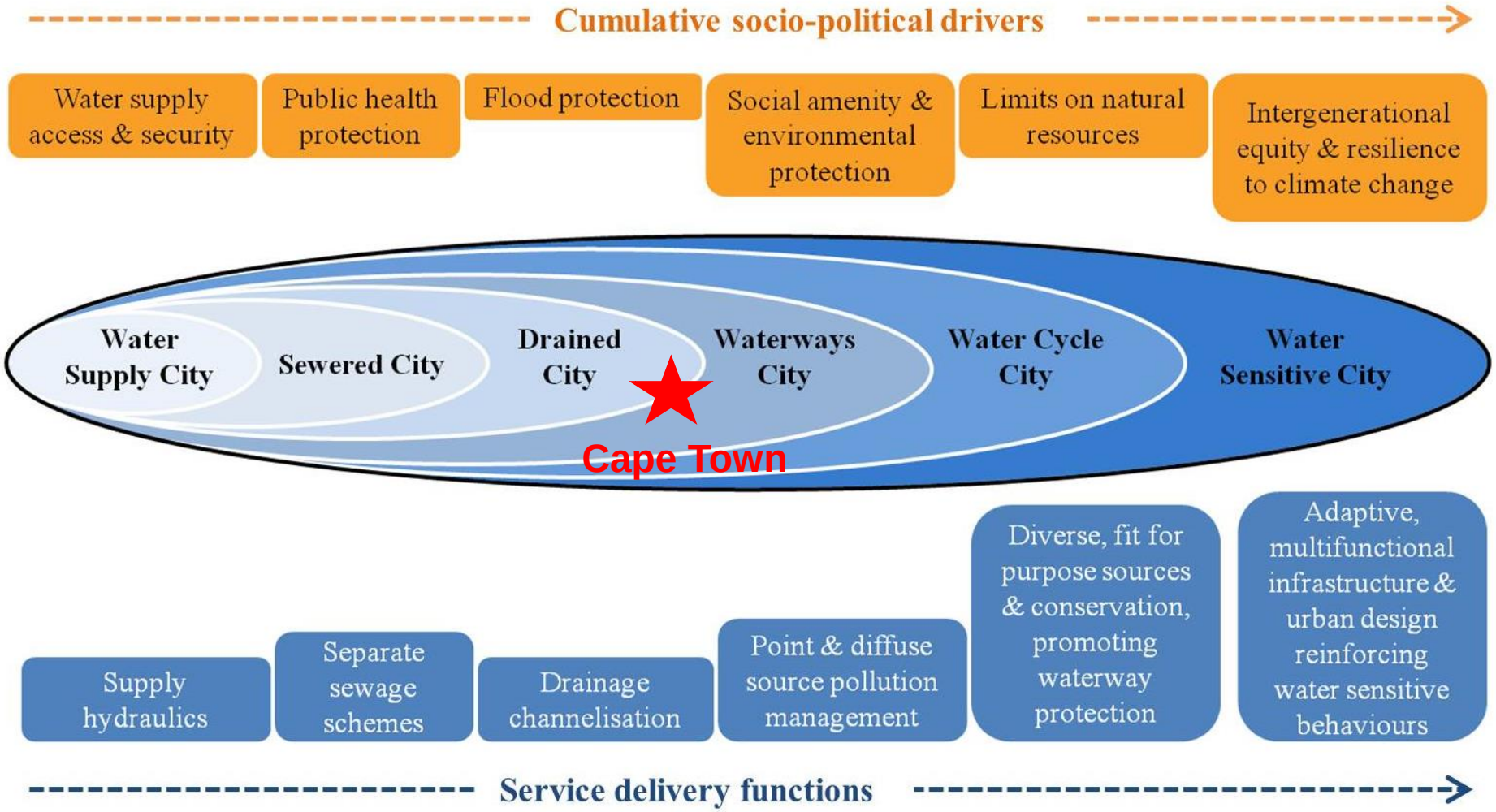
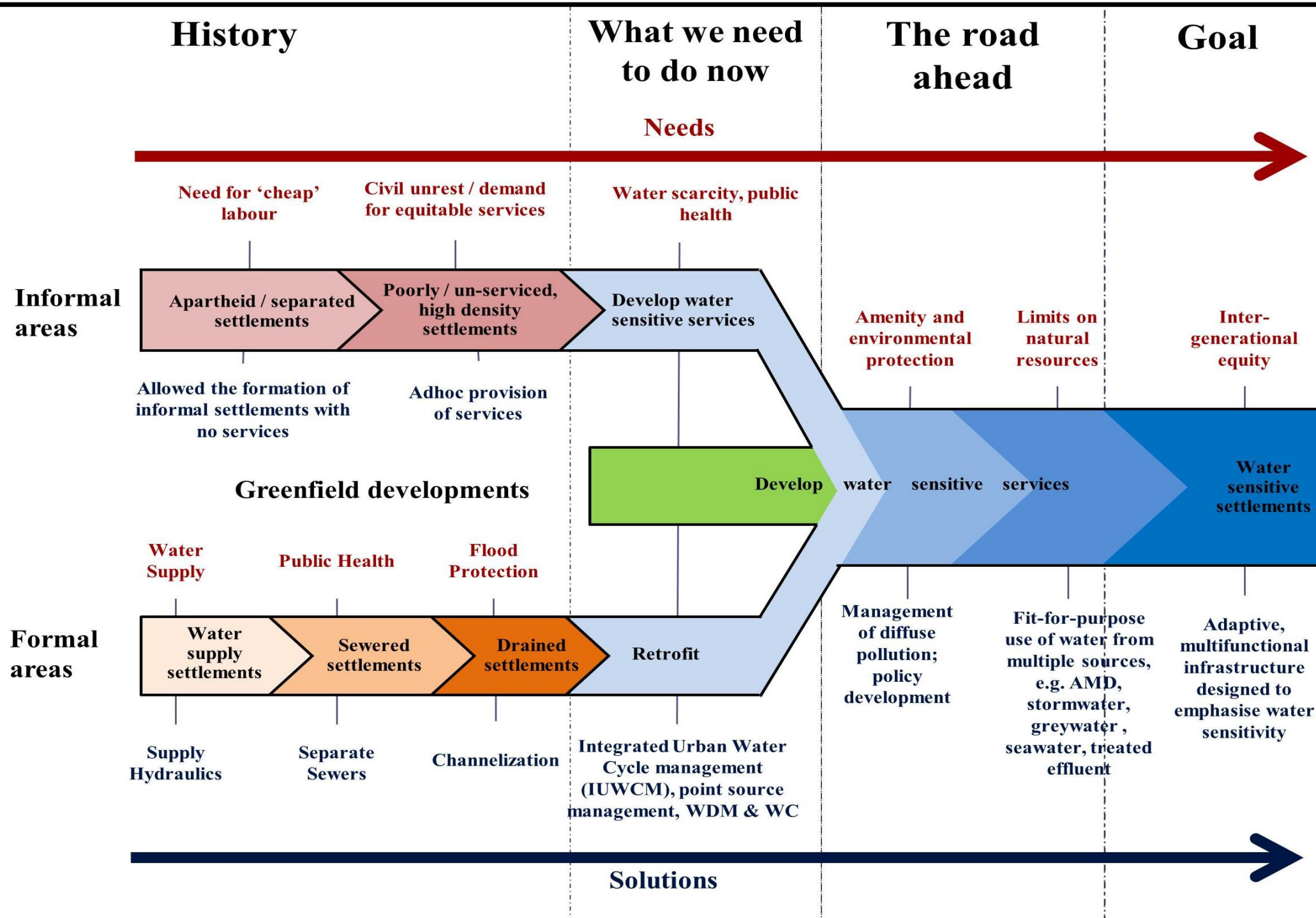
WSD in SA – the narrative

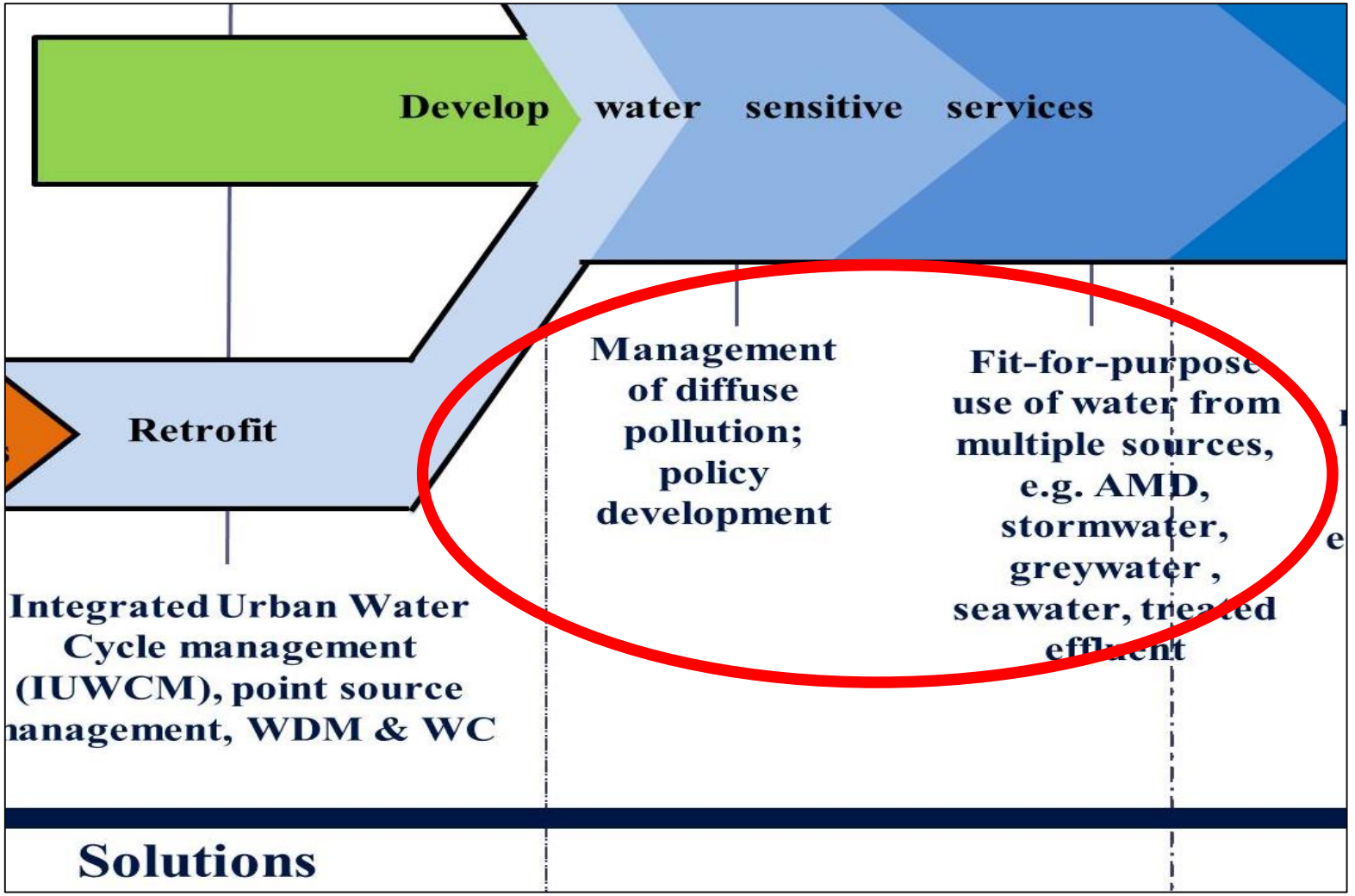


Water sensitive cities framework



Source: Brown et al. (2009)


History
What we need to do now
The road ahead
Goal
Needs
Need for 'cheap' labour
Civil unrest / demand for equitable services
Water scarcity, public health
Informal areas
Apartheid / separated settlements
Poorly / un-serviced, high density settlements
Develop water sensitive services
Amenity and environmental protection
Limits on natural resources
Inter-generational equity
Allowed the formation of informal settlements with no services
Adhoc provision of services
Greenfield developments
Develop water sensitive services
Water sensitive settlements
Water Supply
Public Health
Flood Protection
Formal areas
Water supply settlements
Sewered settlements
Drained settlements
Retrofit
Management of diffuse pollution; policy development
Fit-for-purpose use of water from multiple sources, e.g. AMD, stormwater, greywater , seawater, treated effluent
Adaptive, multifunctional infrastructure designed to emphasise water sensitivity
Supply Hydraulics
Separate Sewers
Channelization
Integrated Urban Water Cycle management (IUWCM), point source management, WDM & WC
Solutions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anagement, WDM & WC
Solutions

Cities as water supply catchments

Water diversity – key to resilience

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‘Closing the gap’ - many sources of water

- Potable water (usually from surface water in RSA)
- Water conservation / water demand management
- Treated wastewater (from treatment works)
- Greywater (from washbasins, showers, baths, kitchen sinks)
- Rainwater (from roofs or similar)
- Stormwater (from the local drainage system)
- Groundwater (including managed aquifer recharge)
- Acid mine drainage
- Seawater
- Virtual water (water used in the production of food and goods elsewhere)

It’s simply a matter of the relative costs and risks

Water conservation / demand management

- Pressure management
- Leak detection
- Tariffs
- Water efficient devices
- Water restrictions
- Awareness campaigns

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Demand management – Bathroom

Demand management - Kitchen

- Pool covers

http://www.poolcoverssa.co.za/solar-2000-pool-blankets.htm

- Rainwater harvesting - indoor use only

http://www.savingwater.co.za/

Wastewater reuse

- schools
- sports clubs
- golf courses
- farms
- industry
- commercial developments

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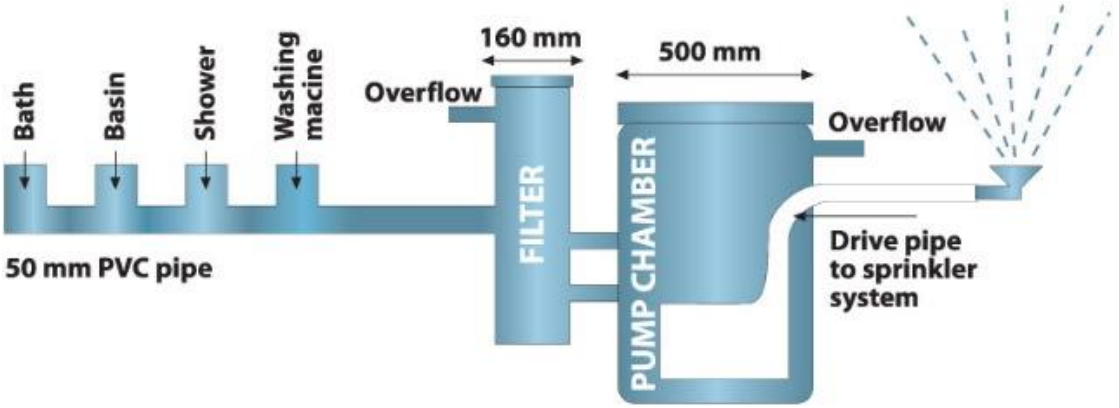
Greywater harvesting



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Stormwater Harvesting – harvesting of water from stormwater systems for water supply (regional scale)

Rainwater Harvesting – harvesting of water from roofs for water supply (private property owners)

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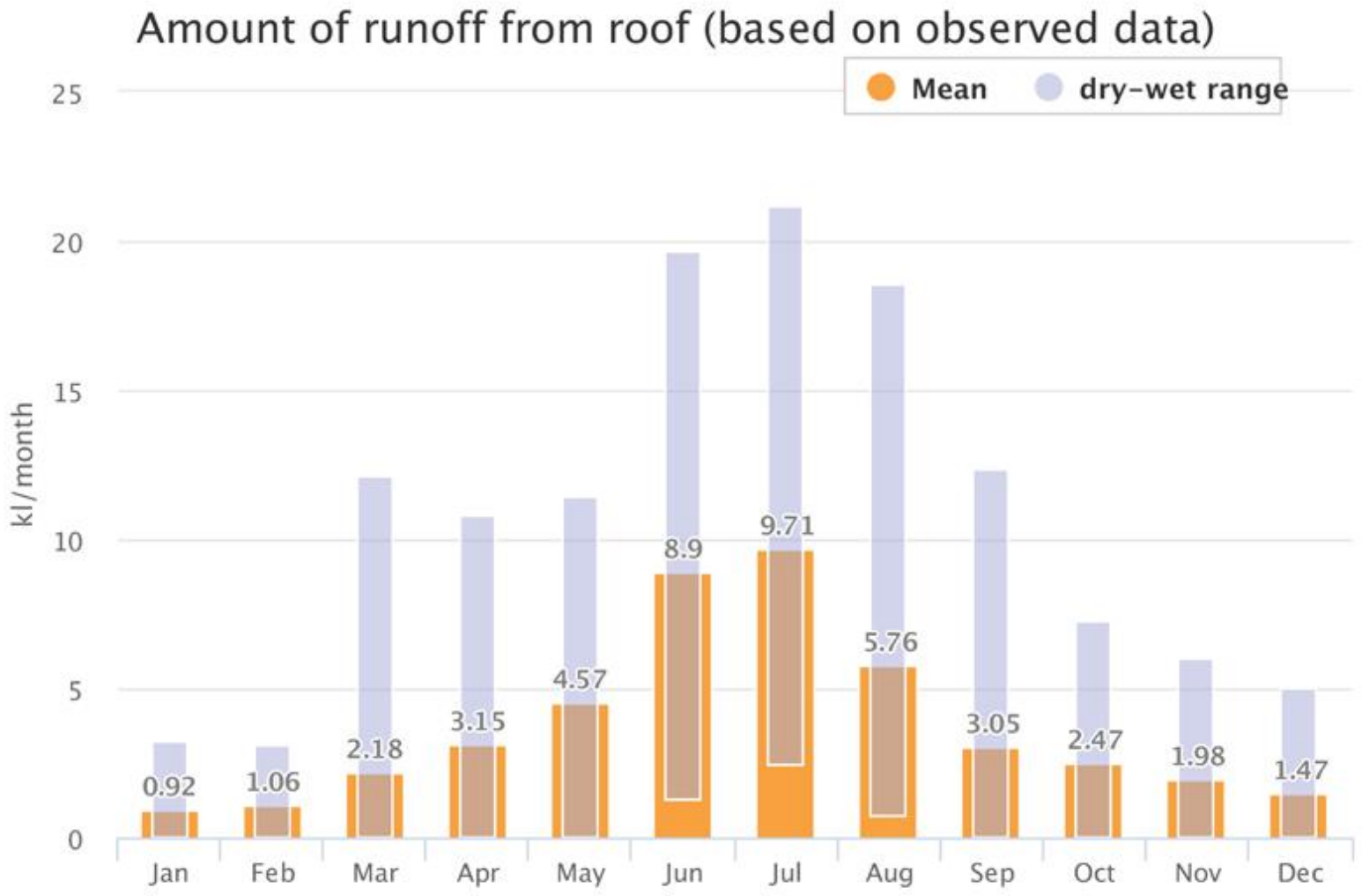
CSAG's Water Harvesting tool



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http://cip.csag.uct.ac.za/waterharvest/

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Stormwater harvesting

COLLECTION

Gutter-pipe
Vegetated swales and strips
Biofilters
Porous pavements
Infiltration systems

TREATMENT

Gross pollutant trap
Oil and sediment separators
Screens
Vegetated swales and strips
Sediment basins and ponds
Constructed wetlands
Aquifer storage and recovery

Biofilters
Filtration systems
Infiltration systems
Sand filters
Disinfection
Membrane filtration

STORAGE & FLOOD PROTECTION

Ponds and lakes
Aquifer storage
Tanks
Constructed wetlands
Infiltration trenches
Porous pavements
Biofilters

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Urban stormwater park / Sponge city – Harbin, China

34 ha urban stormwater park provides multiple ecosystems services:

- collects, cleanses and stores stormwater, infiltrates to aquifer
- protects/recovers natural habitats
- aesthetically appealing public space for recreational use

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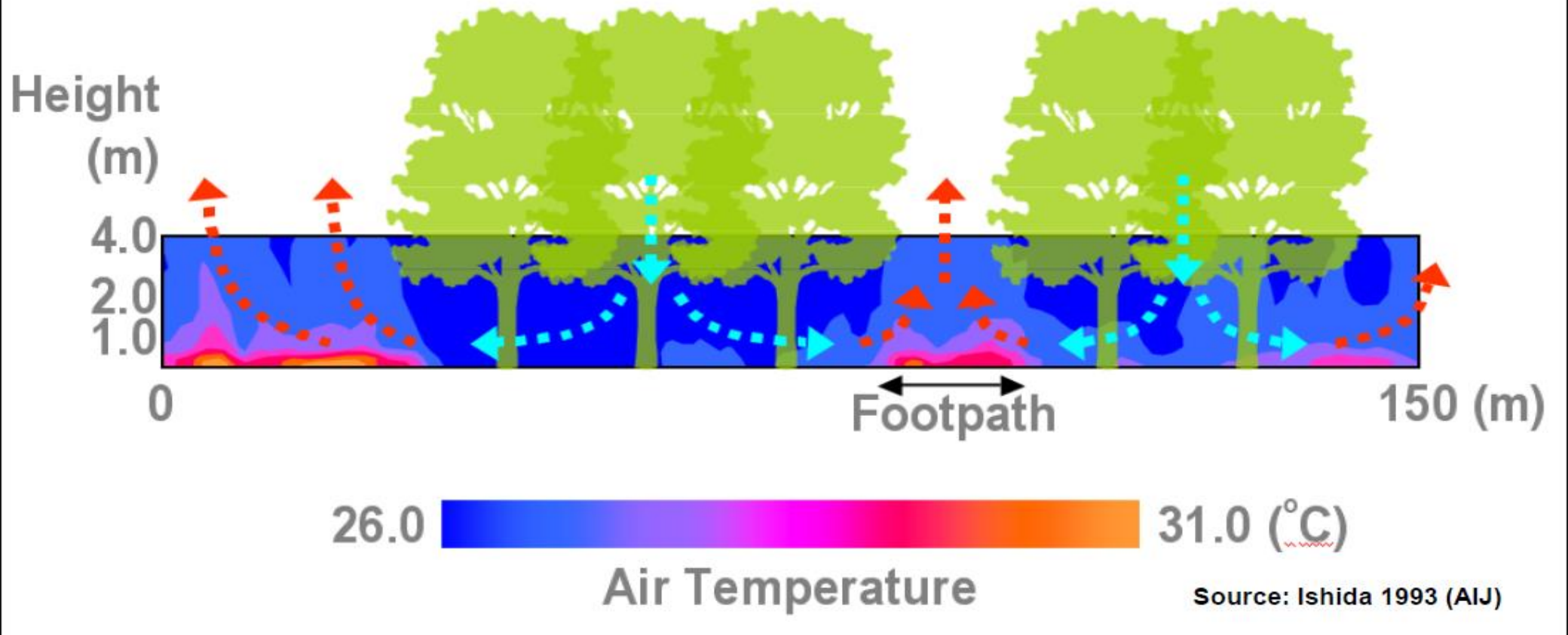
Requirements for a Sponge City

- Contiguous open green spaces and interconnected waterways
- Green roofs
- Porous design interventions across the city, including construction of bio-swales and bio-retention systems (SuDS)
- Water savings and recycling
- Incentivizing consumers to save water through increased tariffs, awareness campaigns, smart monitoring systems

Cities providing ecosystem services


Green Walls



Source: Ishida 1993 (AIJ)

It’s pretty obvious here

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But what does it mean here?

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What are the challenges?

- Equity
  - Dignity; ownership; respect
  - Provide basic services first
  - Give people basic skills at all levels
- Creating systems that can be adapted readily for the future
  - Not technologically locked-into regrettable solutions
- Mitigating climate change
  - Reducing energy and carbon use
  - Building resilience
- Increasing uncertainty
  - Population growth, demographics and lifestyles / needs (standards of living)

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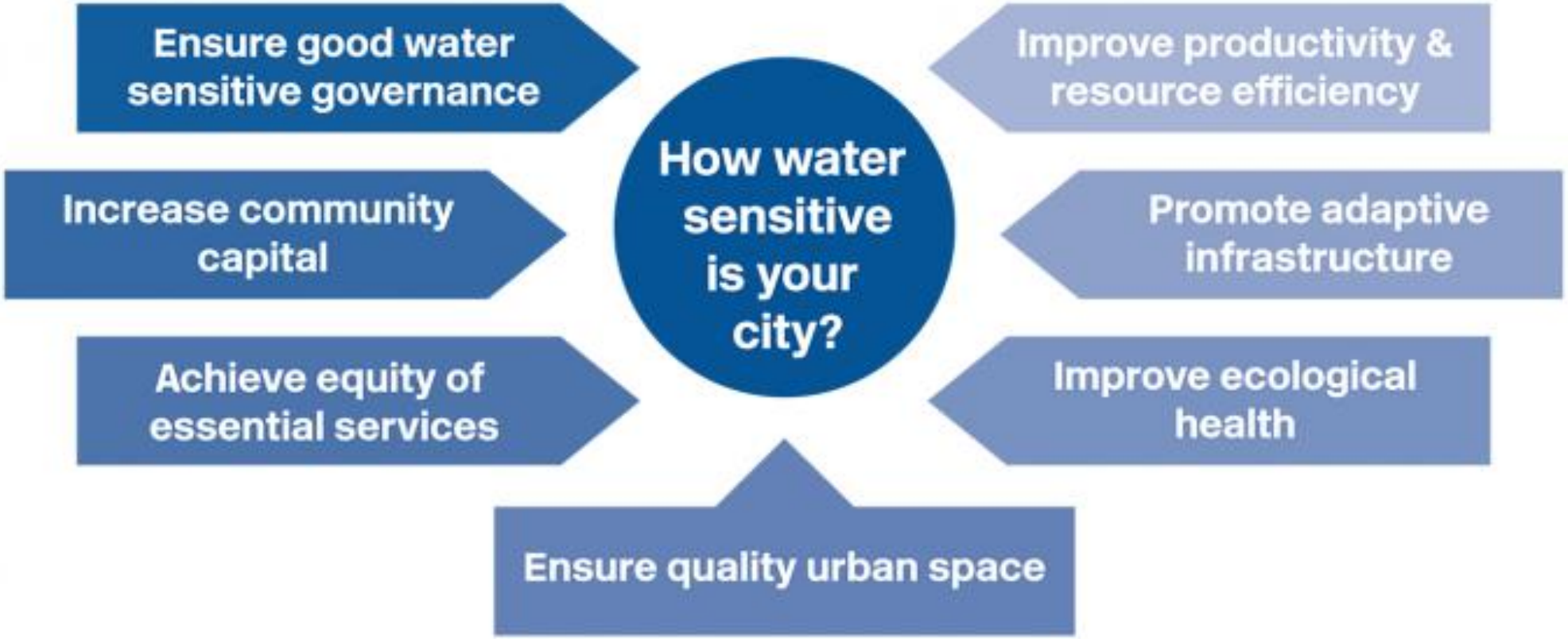
What needs to be done?



Source: CRSWSC Water Sensitive Cities Index

See also: www.iwa-network.org/projects/water-wise-cities/

Last thought

"A good crisis has gone to waste in terms of the public level response," he said. "Businesses have learned that demand-side solutions are cheaper and easier. That should be the place to start. But engineers invariably want to put more supply in the system. They fail to recognise that green assets [forests] appreciate over time unlike grey assets [concrete dams]. The government should be looking at both."

Alexis Morgan, WWF – on 2015 water crisis in São Paulo, Brazil

https://www.theguardian.com/cities/2017/nov/28/sao-paulo-water-amazon-deforestation

Blue economy initiative

http://www.cwn-rce.ca/about-us/blue-economy-initiative

Thank you

For more information:

www.uwm.uct.ac.za

www.futurewater.uct.ac.za

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