Urban water innovations to reduce vulnerability of urban areas

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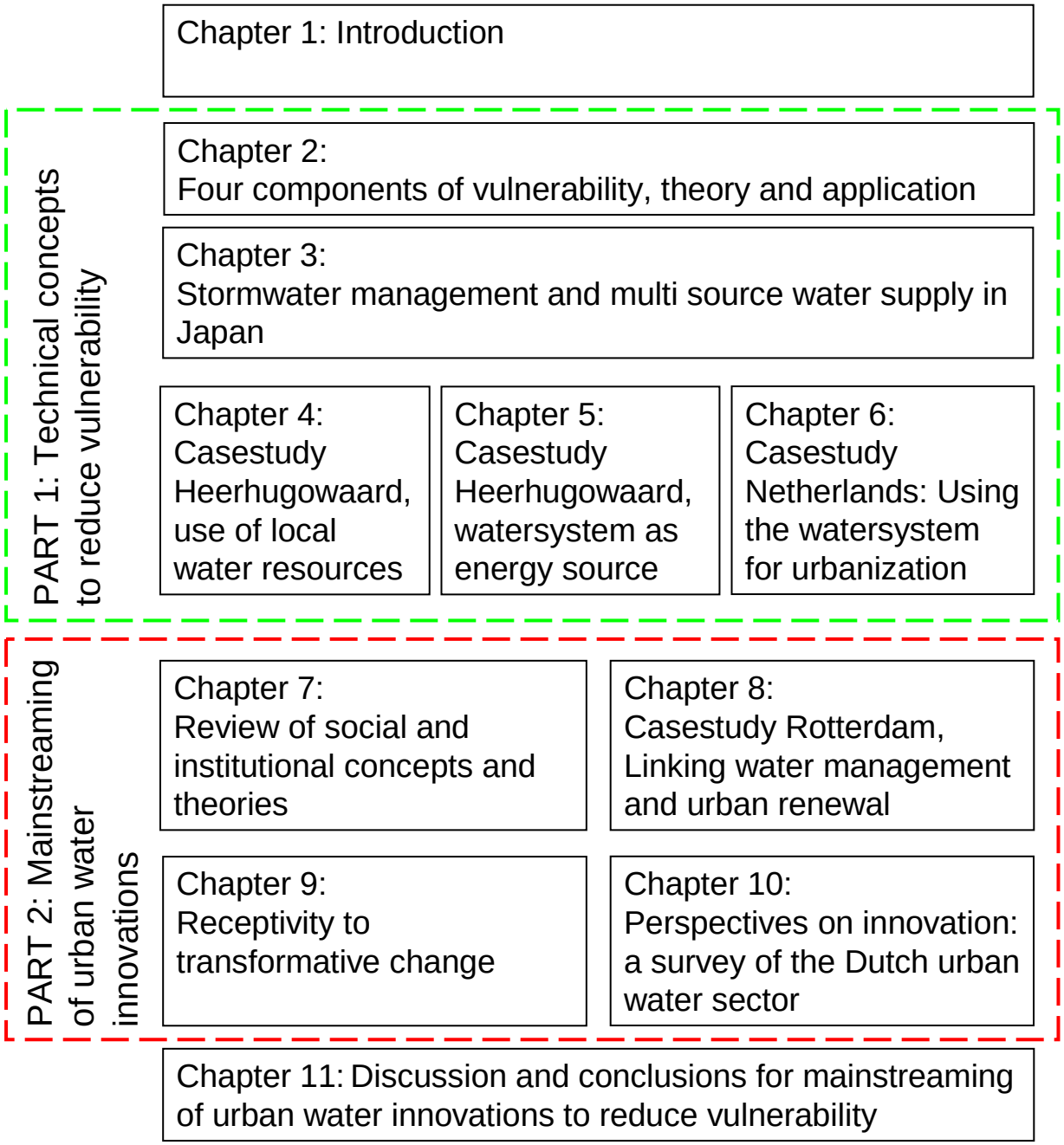
Acknowledgements


Chapter 1: Introduction
PART 1: Technical concepts to reduce vulnerability
Chapter 2:
Four components of vulnerability, theory and application
Chapter 3:
Stormwater management and multi source water supply in Japan
Chapter 4:
Casestudy Heerhugowaard, use of local water resources
Chapter 5:
Casestudy Heerhugowaard, watersystem as energy source
Chapter 6:
Casestudy Netherlands: Using the watersystem for urbanization
PART 2: Mainstreaming of urban water innovations
Chapter 7:
Review of social and institutional concepts and theories
Chapter 8:
Casestudy Rotterdam, Linking water management and urban renewal
Chapter 9:
Receptivity to transformative change
Chapter 10:
Perspectives on innovation: a survey of the Dutch urban water sector
Chapter 11: Discussion and conclusions for mainstreaming of urban water innovations to reduce vulnerability

Outline

- PART 1: URBAN WATER INNOVATIONS TO REDUCE VULNERABILITY OF CITIES
  - Framework
  - Examples from Japan
  - Examples from Australia
  - Three innovations
- PART 2: MAINSTREAMING OF INNOVATIONS
  - Socio technical regimes, transitions
  - Rotterdam watercity 2035
  - Receptivity

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The concept of vulnerability

- Possible responses towards environmental variation that reduce vulnerability:
  - Reduce (or control!) environmental variation → Building a threshold, example:
  - Reduce damage if this threshold is exceeded → Develop ability to cope with impacts
  - Recover quickly and effectively after damage has occurred → Develop ability to recover
  - If future variation is uncertain and potential impacts are large → Develop ability to adapt

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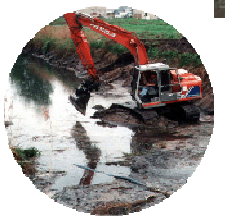
The concept of vulnerability

	Type	*Time orientation*	*Responsibility*
Threshold Capacity	Damage prevention	Past	Clear
Coping Capacity	Damage reduction	Instant	Not clear
Recovery Capacity	Damage reaction	Instant/ future	Not clear
Adaptive Capacity	Damage anticipation	Future	Undefined



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The concept of vulnerability

	Flood control	*Flood control*	*Water supply*	*Water supply*
Threshold Capacity	Higher dikes	Increase river capacity	Increased reservoir capacity	More efficient supply infra
Coping Capacity	Improve risk perception	Emergency plan & warning	Backup supply facilities	Individual storage
Recovery Capacity	Disaster funds & Insurance	Recovery plans	Multi-source water supply	Disaster funds & Insurance
Adaptive Capacity	Flood proof & flexible urbanization	Small scale pilot projects	Flexible portfolio of sources	Small scale pilot projects

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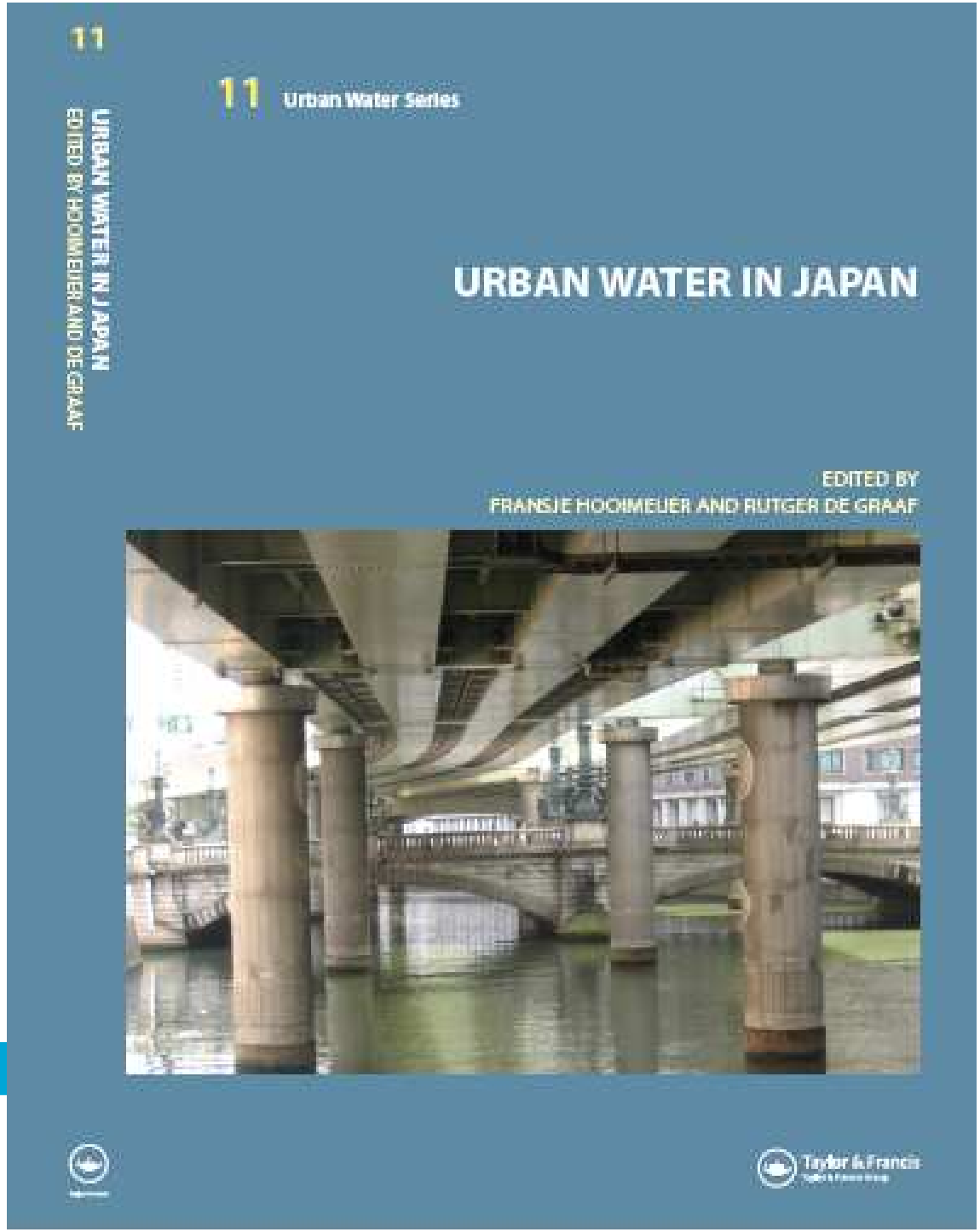

Outline

- **Chapter 1: Introduction**
  Prof. Kenichi Koga, Prof. Hiroaki Furumai, Dr. Frans van de Ven
- **Chapter 2: History of Urban Water in Japan**
  Fransje Hooimeijer
- **Chapter 3: Historical Floods with responding flood control**
  Yoshito Kikumori & Bianca Stalenberg
- **Chapter 4: The development of river management: Tone River**
  Satoshi Nakazawa
- **Chapter 5: Urban flood control on the rivers of Tokyo Metropolitan**
  Yoshito Kikumori & Bianca Stalenberg
- **Chapter 6: Stormwater management and multi-source water supply**
  Prof. Jun Matsushita & Rutger de Graaf
- **Chapter 7: Development of lowland areas**
  Prof. Hiroyuki Araki & Dr.Olivier Hoes
- **Chapter 7: Parallel plan making approach for urban water management**
  Dr. Govert D. Geldof & Prof. Shoichi Fujita
- **Chapter 8: Challenges for delta areas in coping with urban floods**
  Prof. Chris Zevenbergen & Dr. S. Herath

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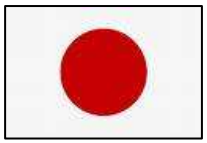
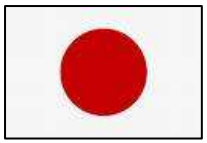
Extreme precipitation


Rainfall (T=10)	Saga [mm]	Shiroishi [mm]	De Bilt [mm]
1 hour	68	61	24
1 day	204	203	52
2 days	269	276	62
3 days	321	332	70

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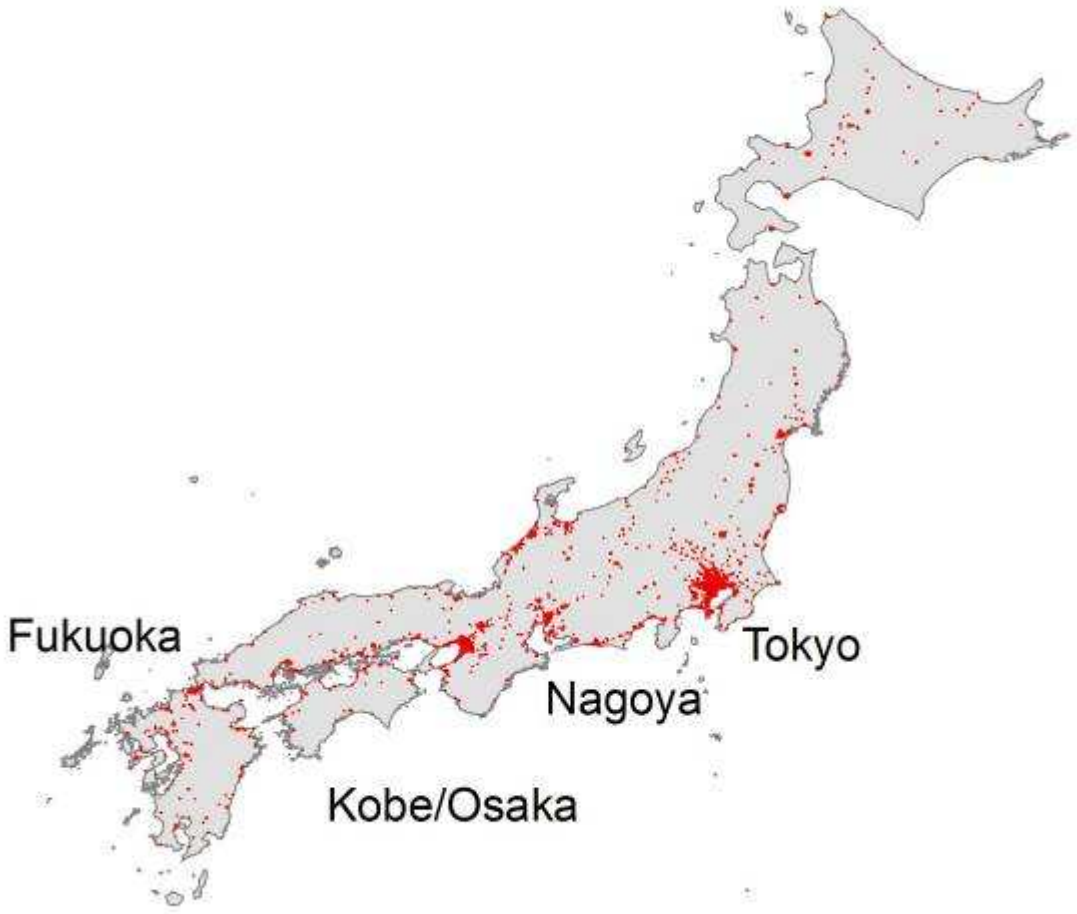
Urbanization in flood prone areas



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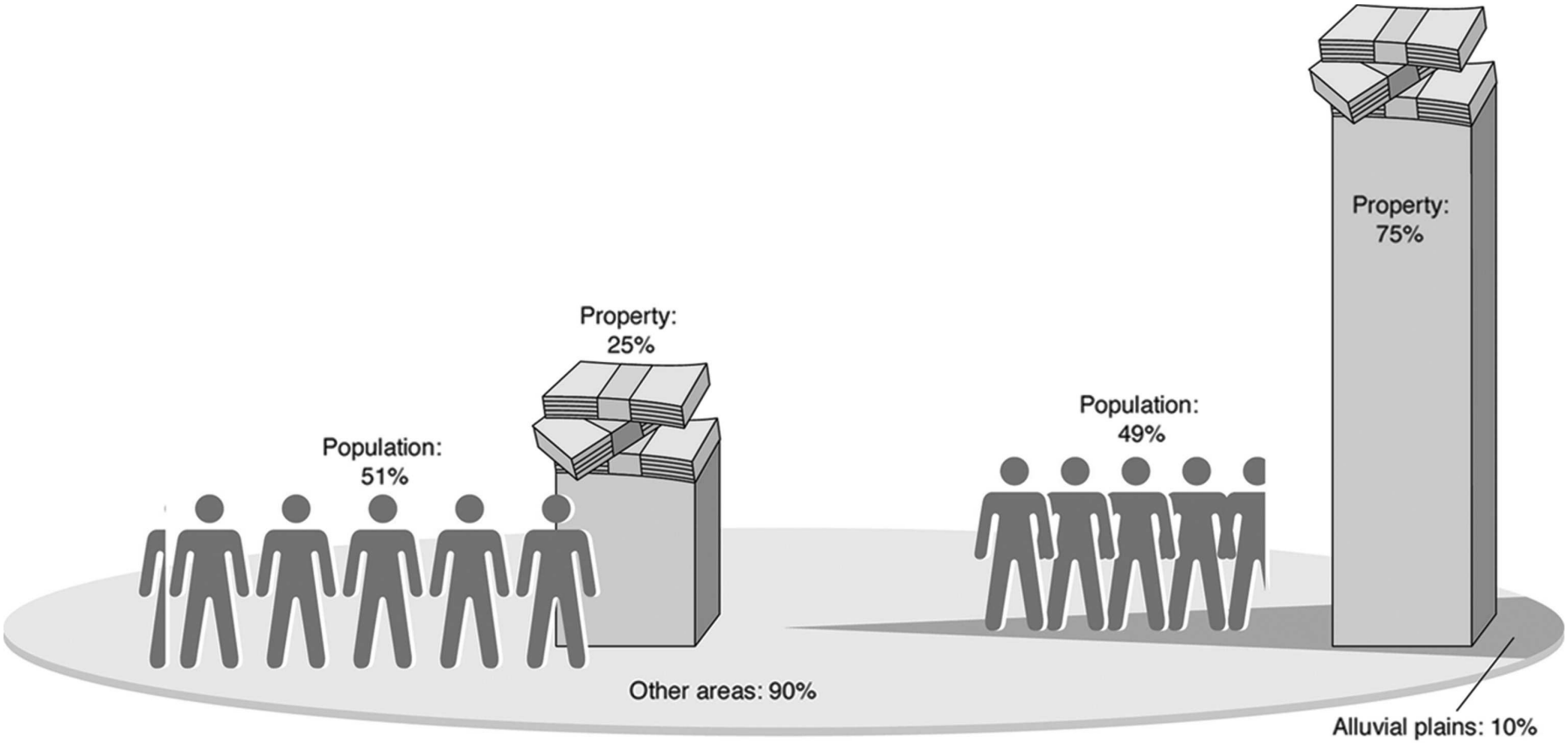
Urbanization in flood prone areas



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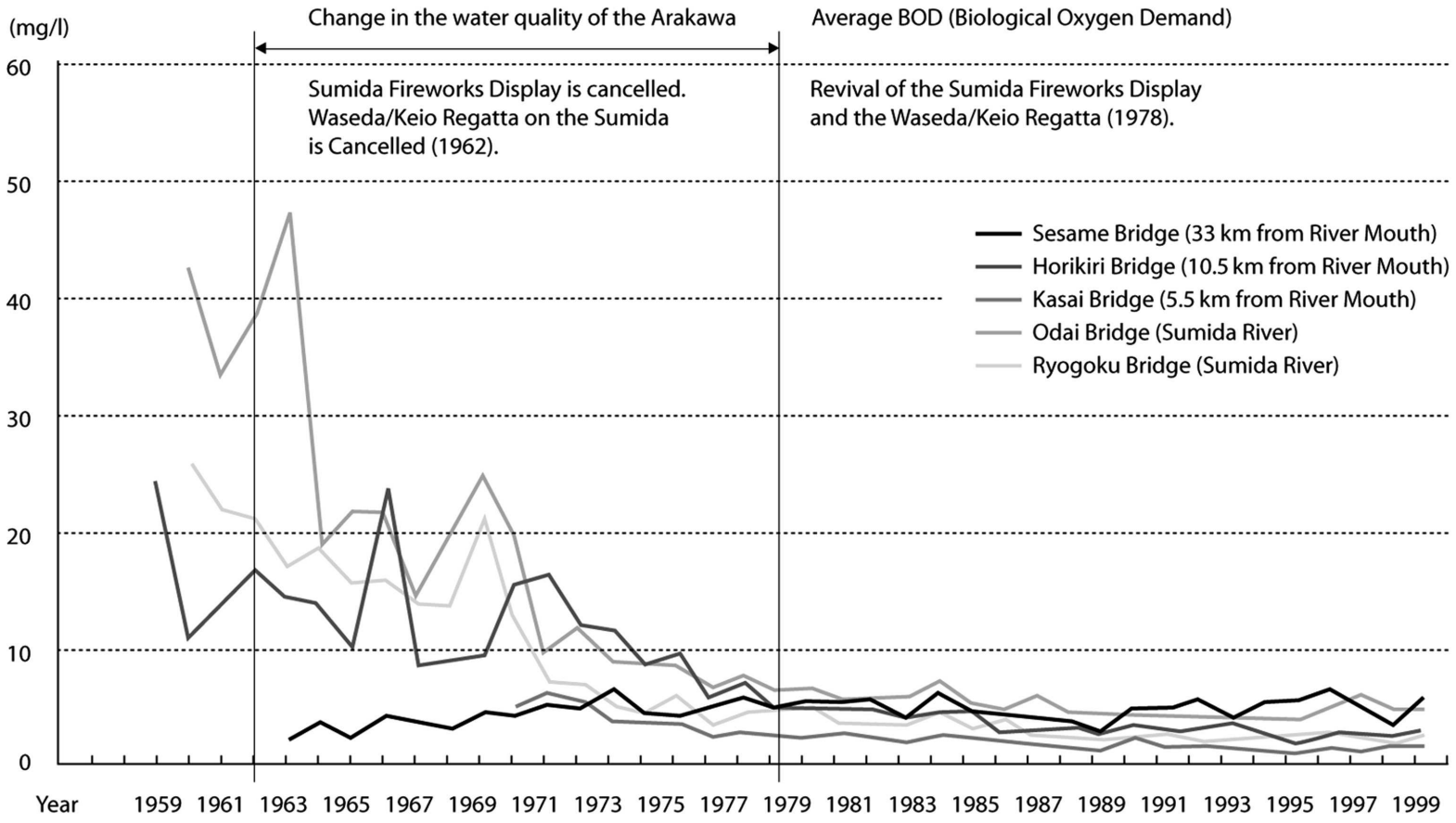
Water quality improvement

Change in the water quality of the Arakawa: average BOD (Biological Oxygen Demand)*



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Experiencing Water

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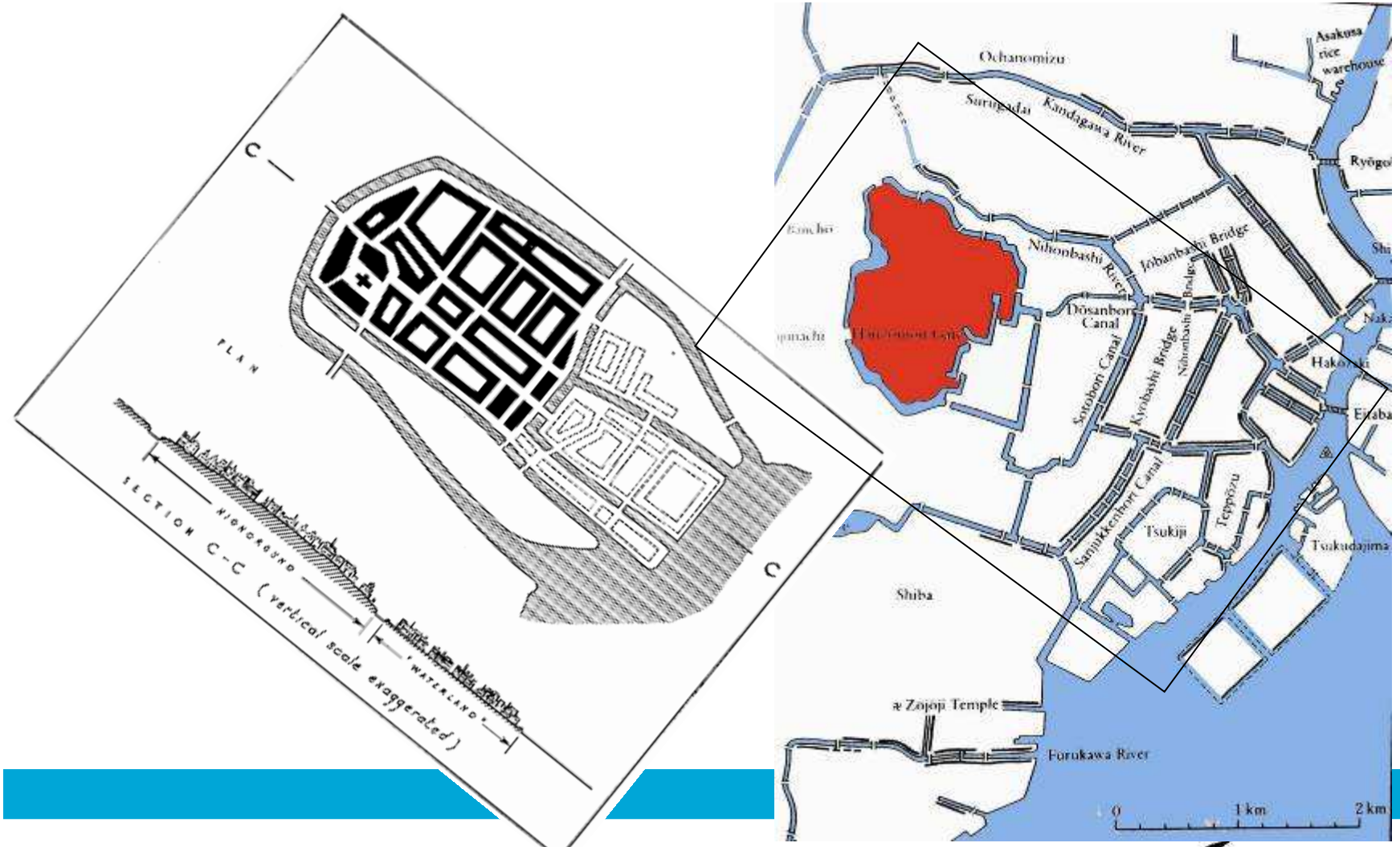
History of urban water in Japan



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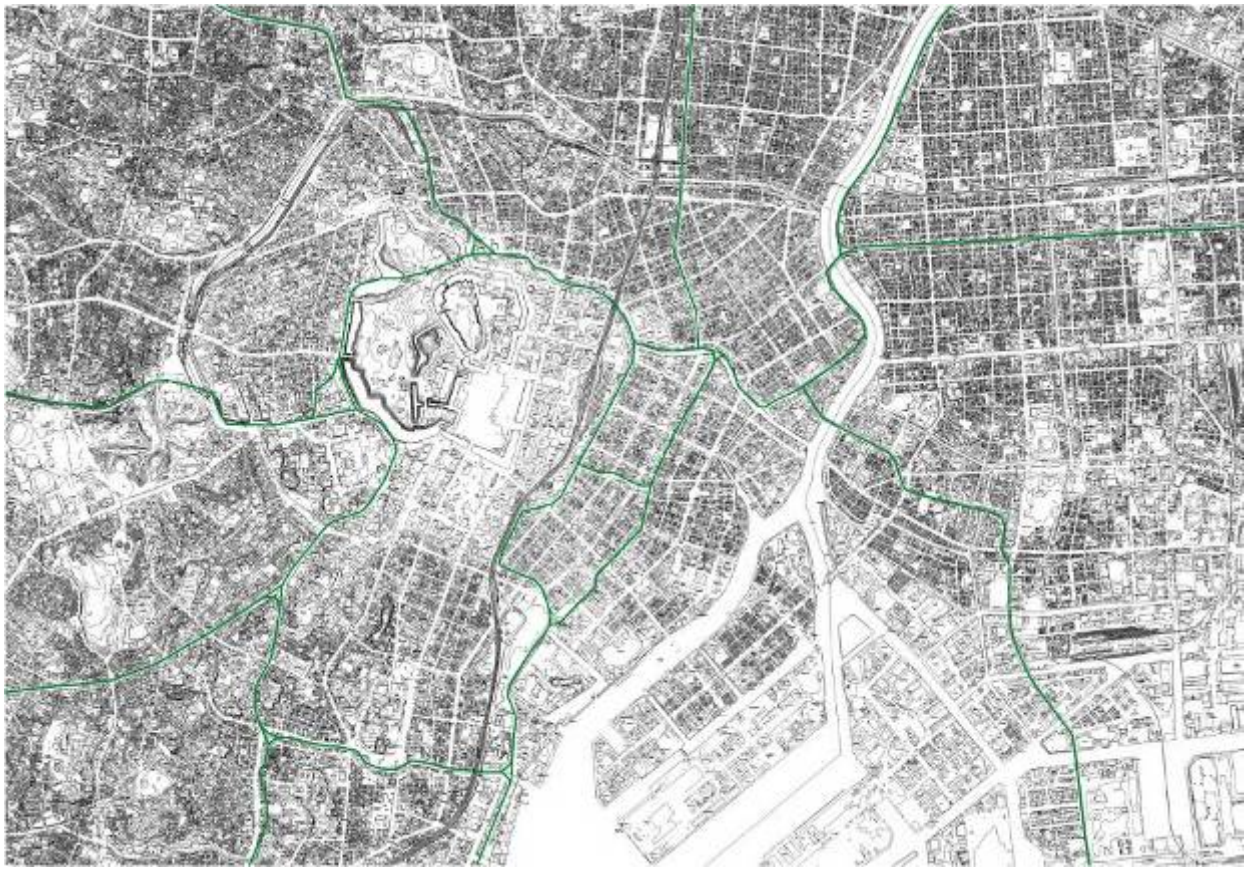
Highway plan Tokyo Olympics 1964



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Construction of highway network

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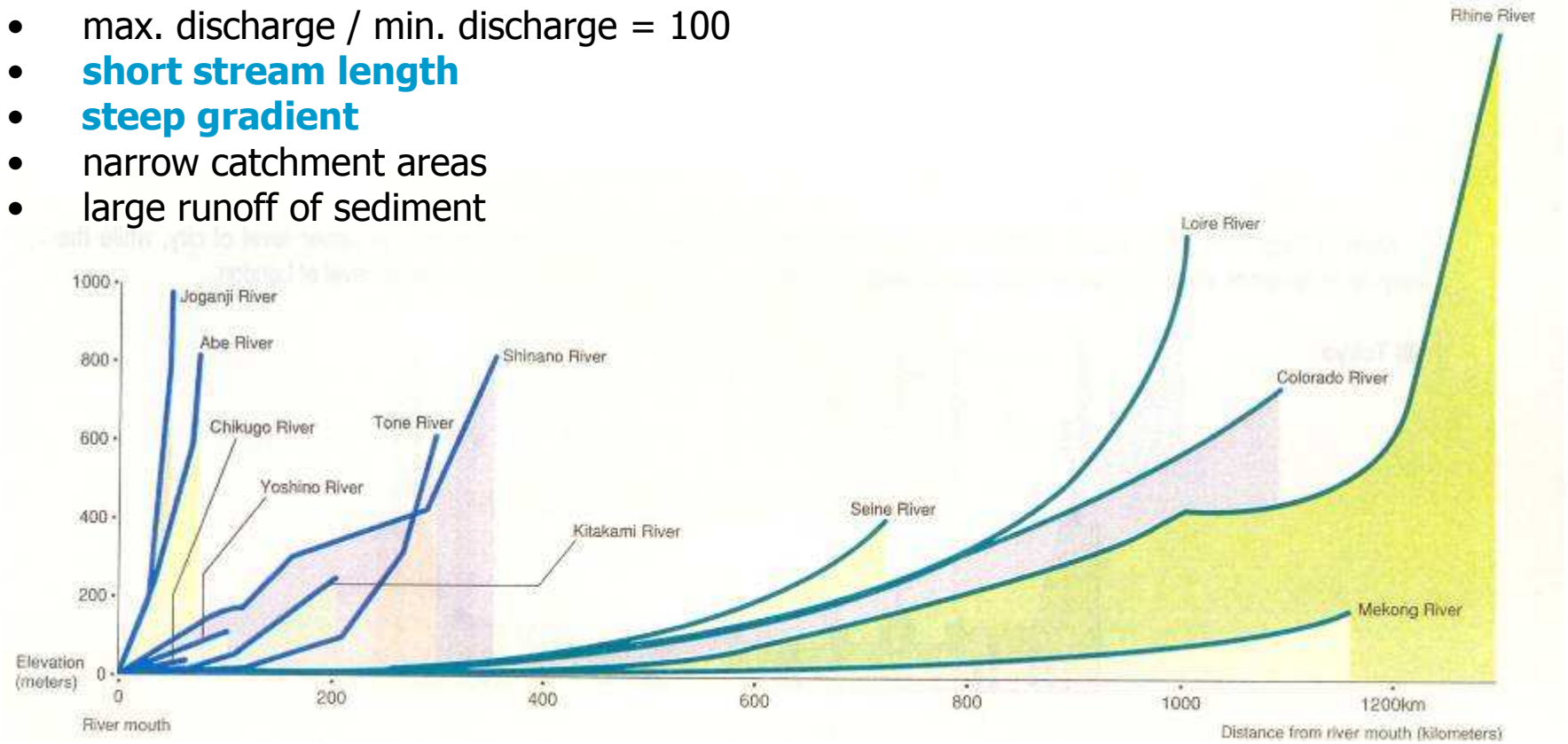
Construction of highway network

Flood Control

- rain rivers
- max. discharge / min. discharge = 100
- **short stream length**
- **steep gradient**
- narrow catchment areas
- large runoff of sediment



Ch3: Historical floods with responding flood control (Kikumori & Stalenberg)

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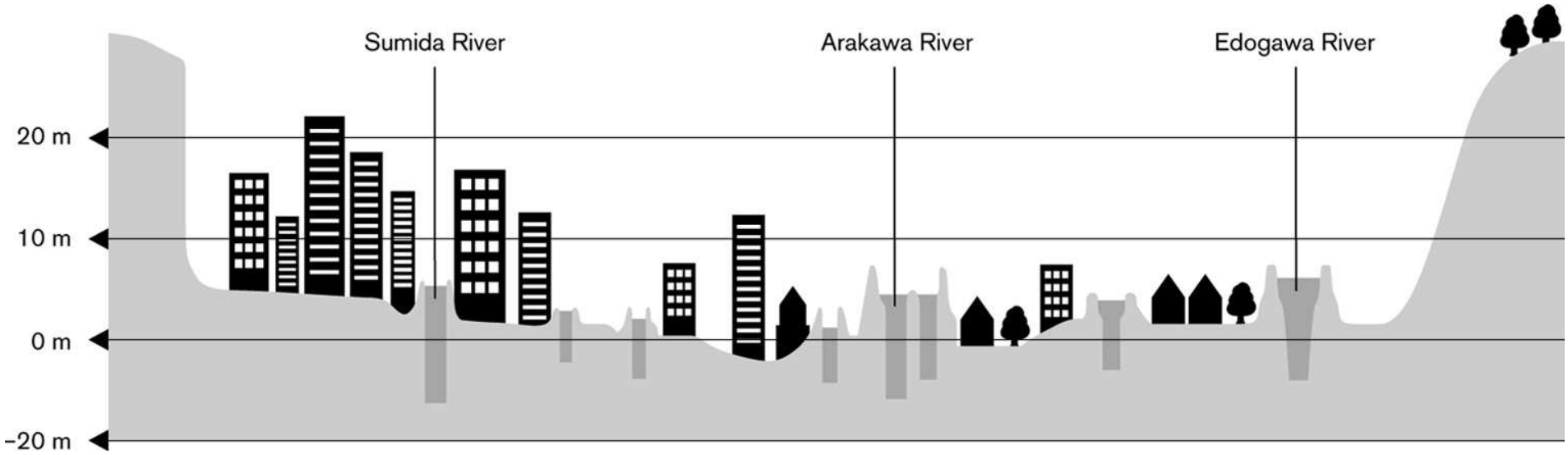
Land elevation level



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Flood control

'The river is nothing but the groundwater you can see'

- Quote from Tokyo University student -

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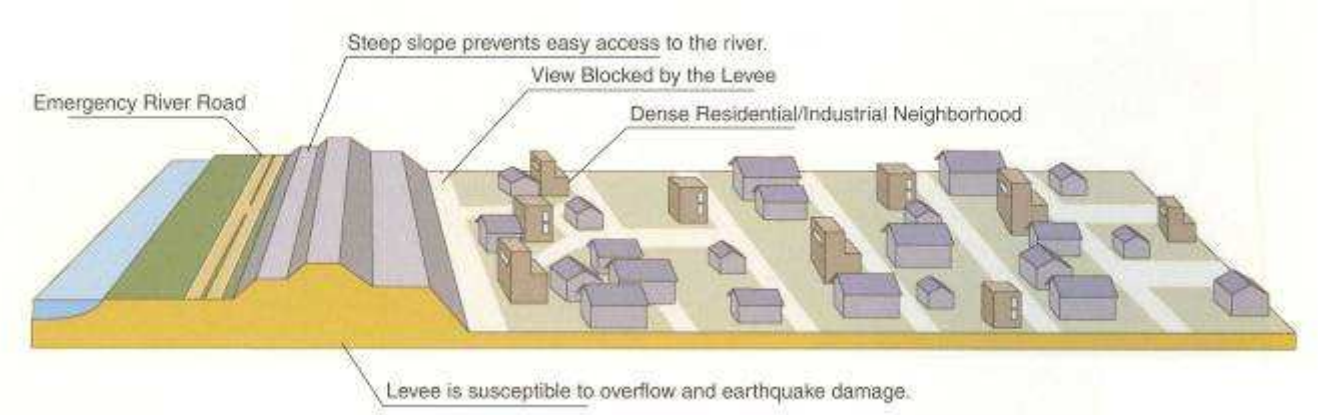
Flood Control



conventional dike

super levee

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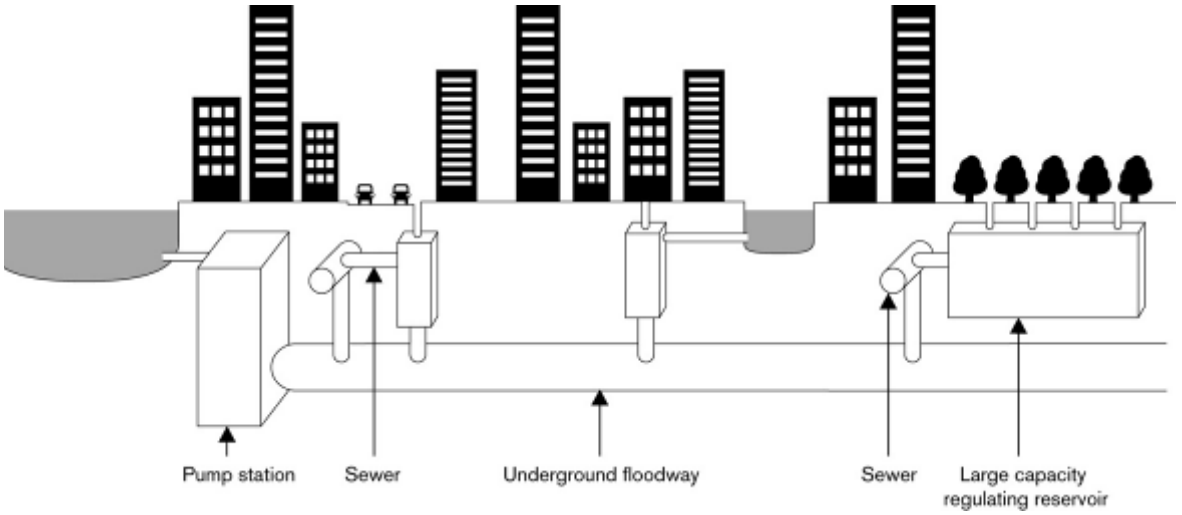
Flood Control



Ch5: Urban Flood Control on the rivers of Tokyo Metropolitan (Kikumori & Stalenberg)

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Rapid Urbanization

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Space for Water

Ch5: Urban Flood Control on the rivers of Tokyo Metropolitan (Kikumori & Stalenberg)

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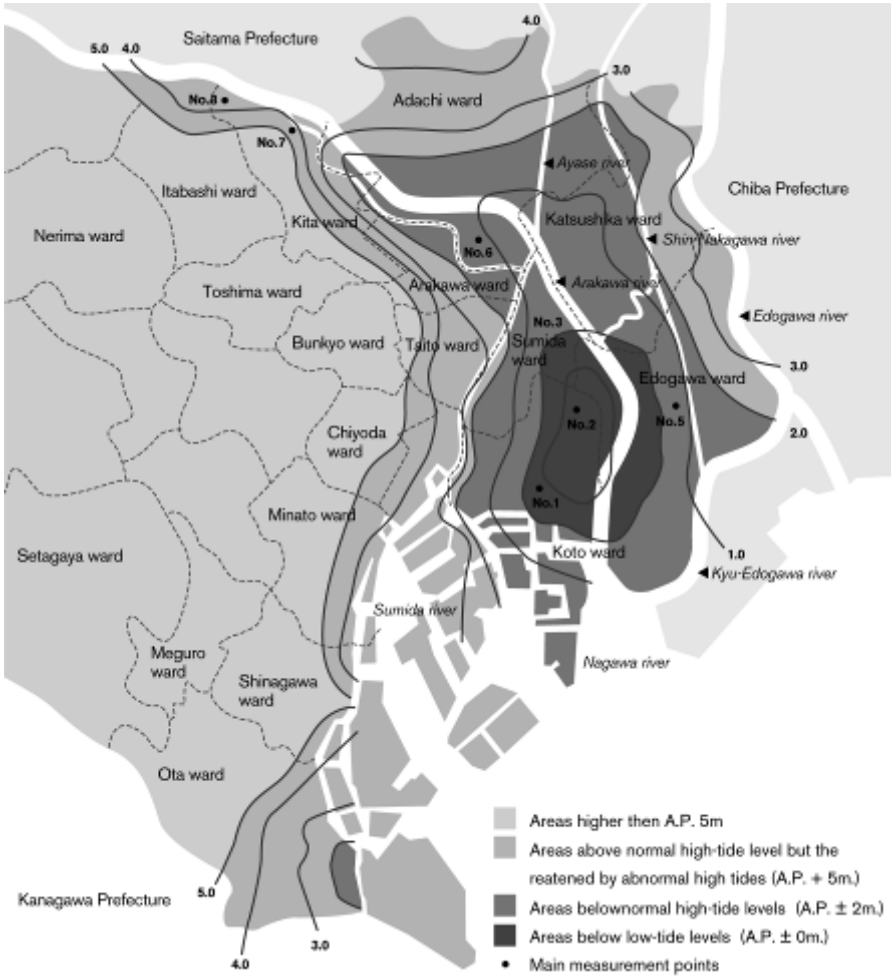
Land subsidence



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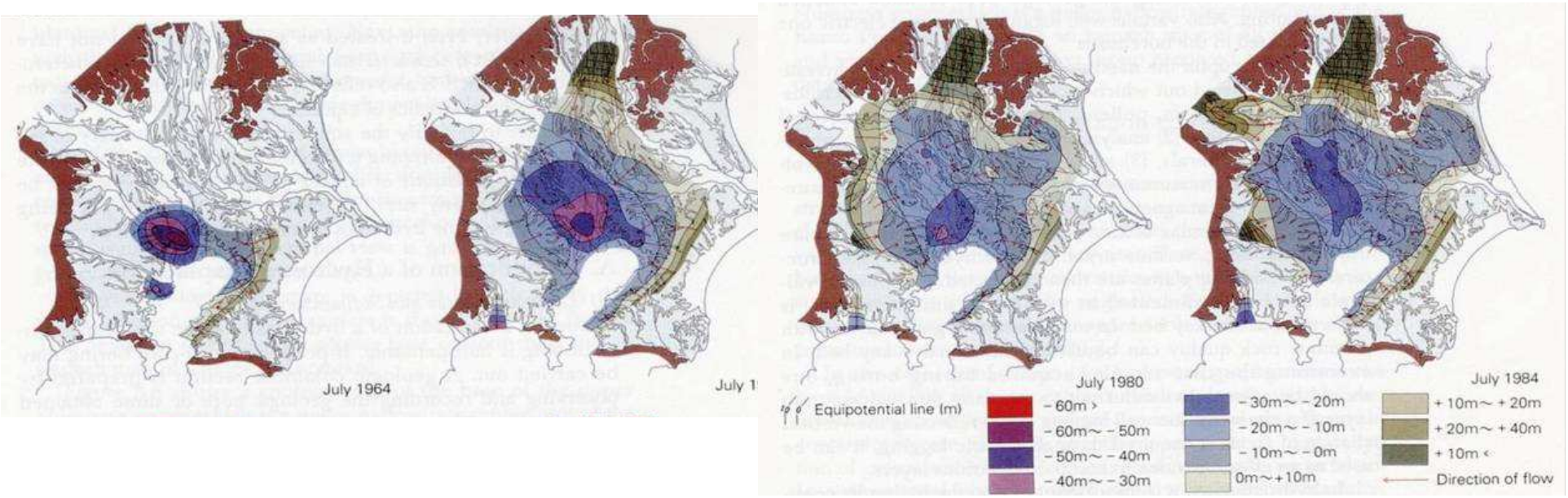
Groundwater



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Stormwater discharge

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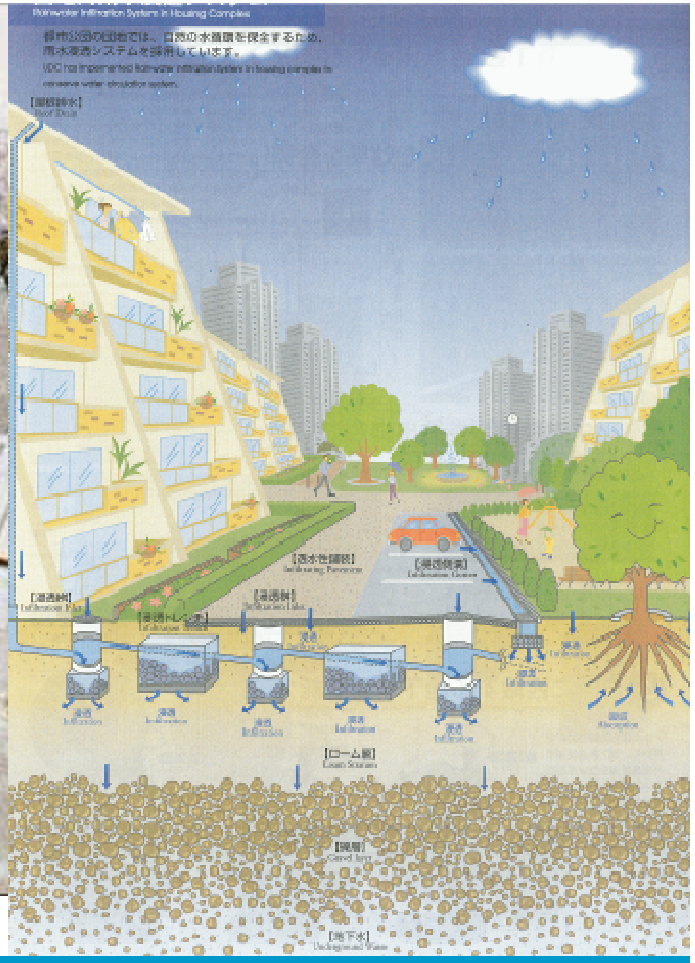
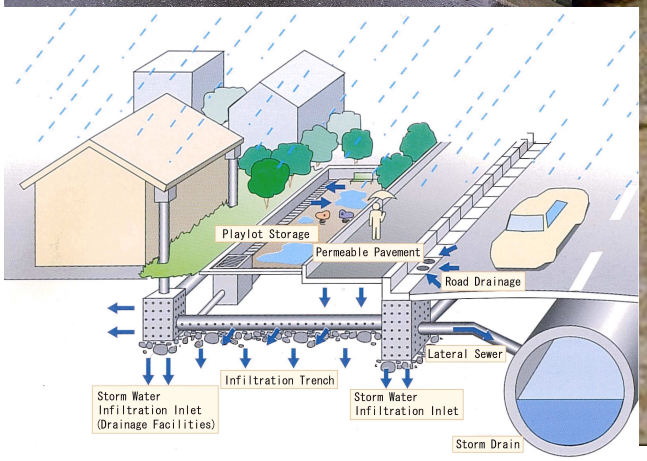
Stormwater infiltration





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Stormwater storage

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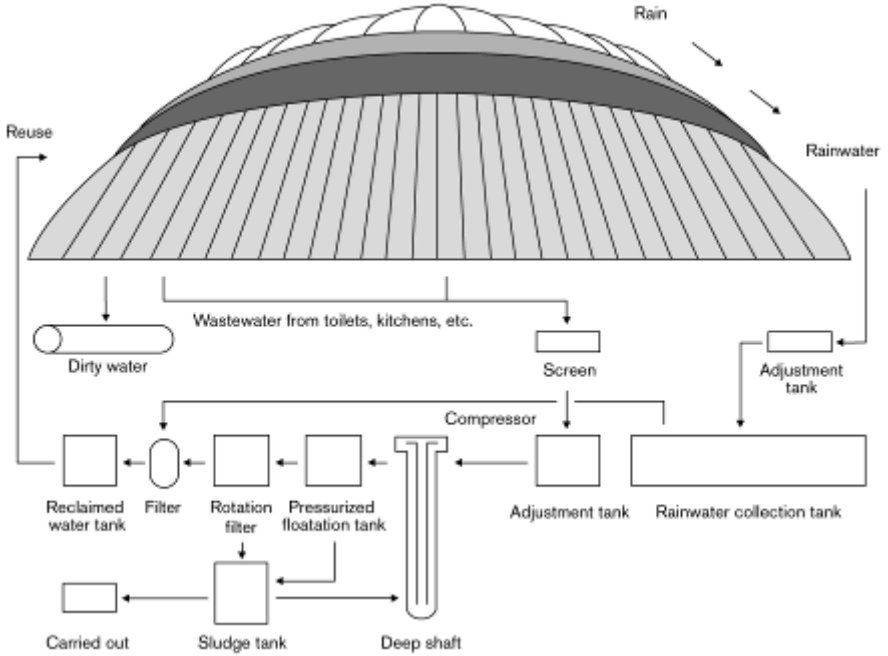
Stormwater recycling



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Stormwater protection

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Water recycling

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Water recycling

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Polders

Polders

Hachirogata

Haarlemmermeer

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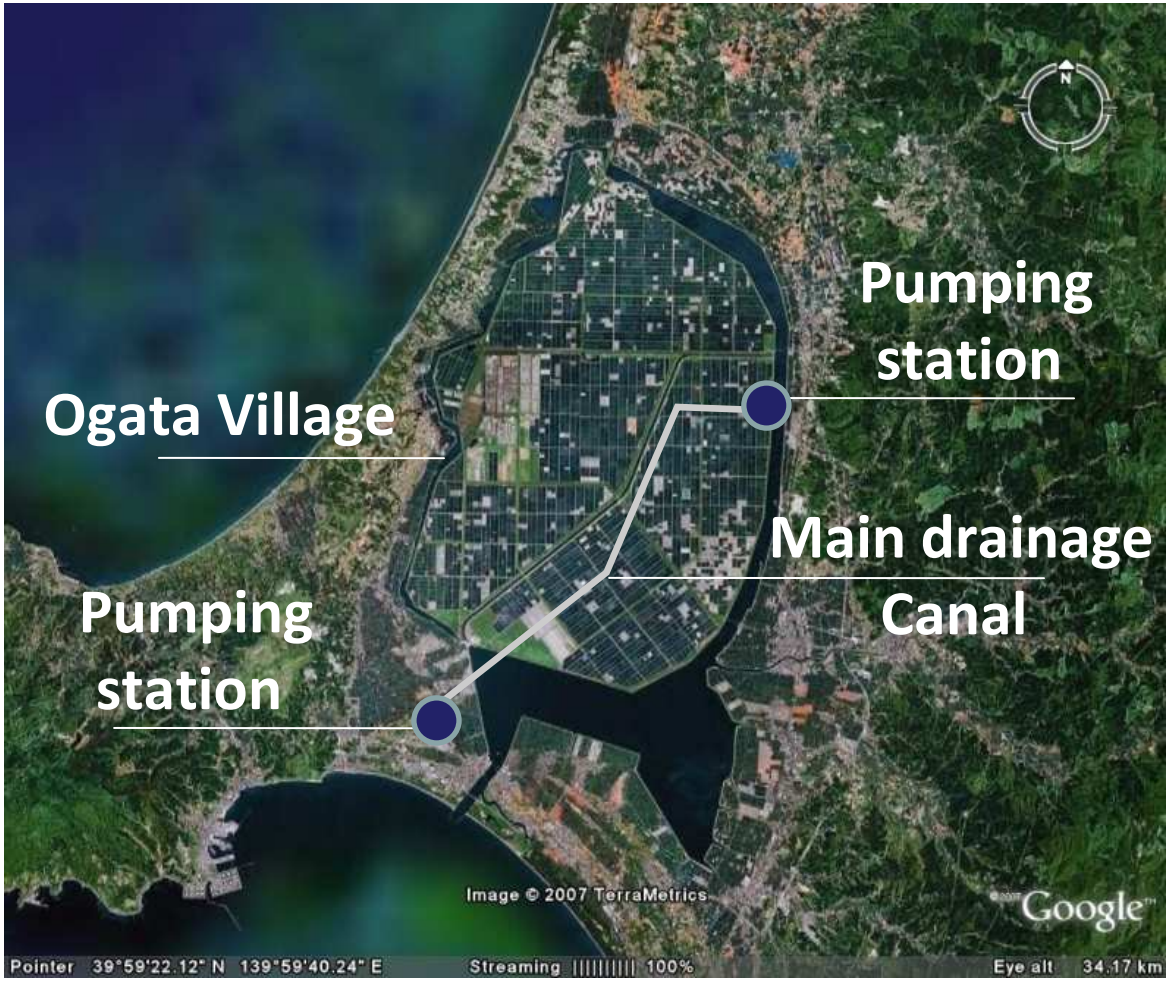
Polders



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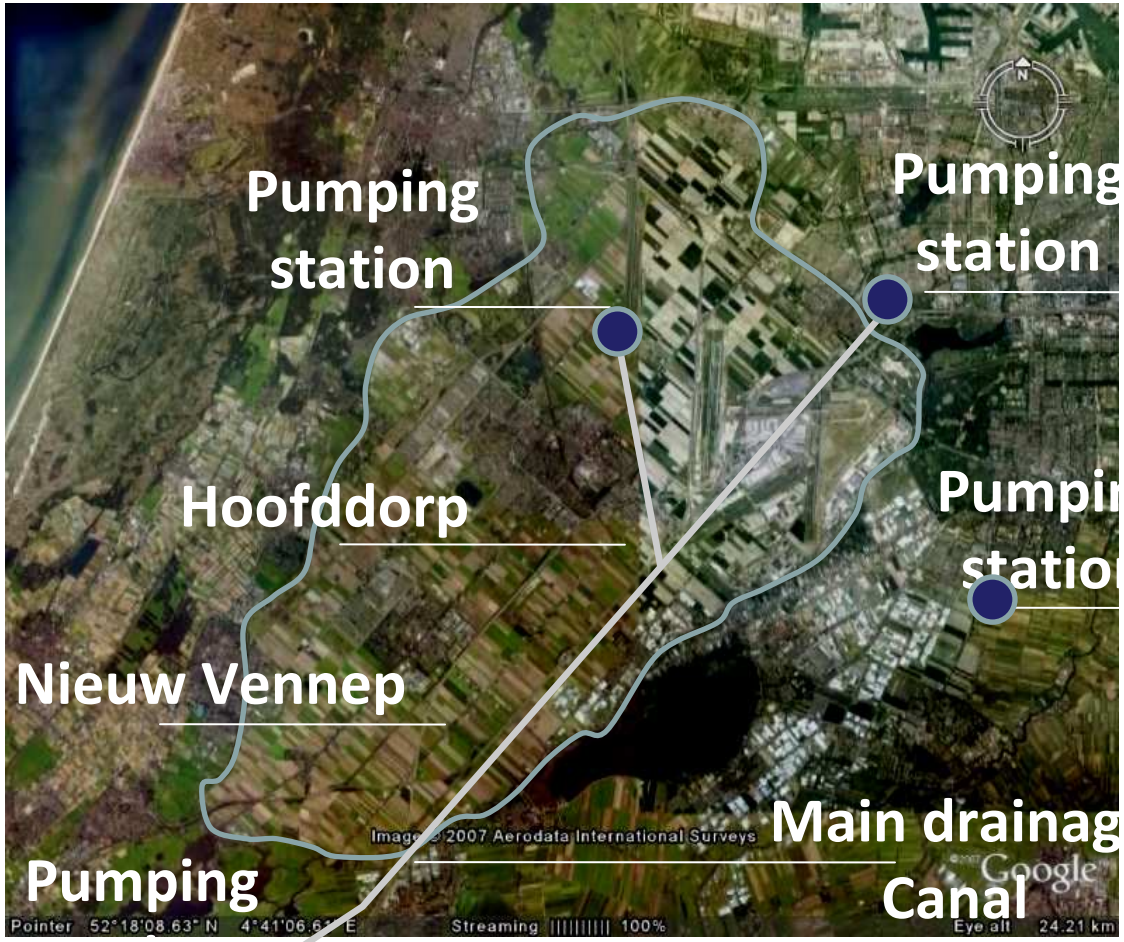

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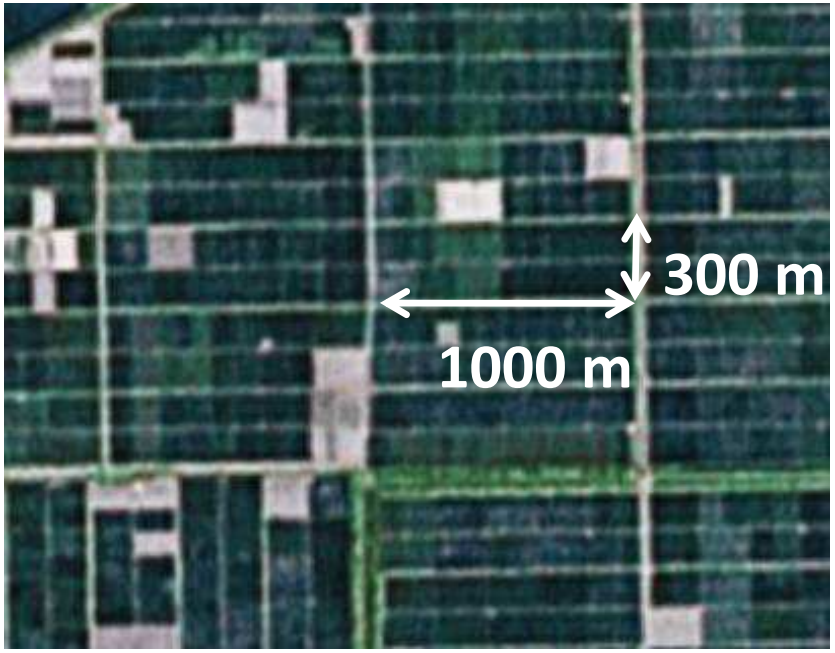
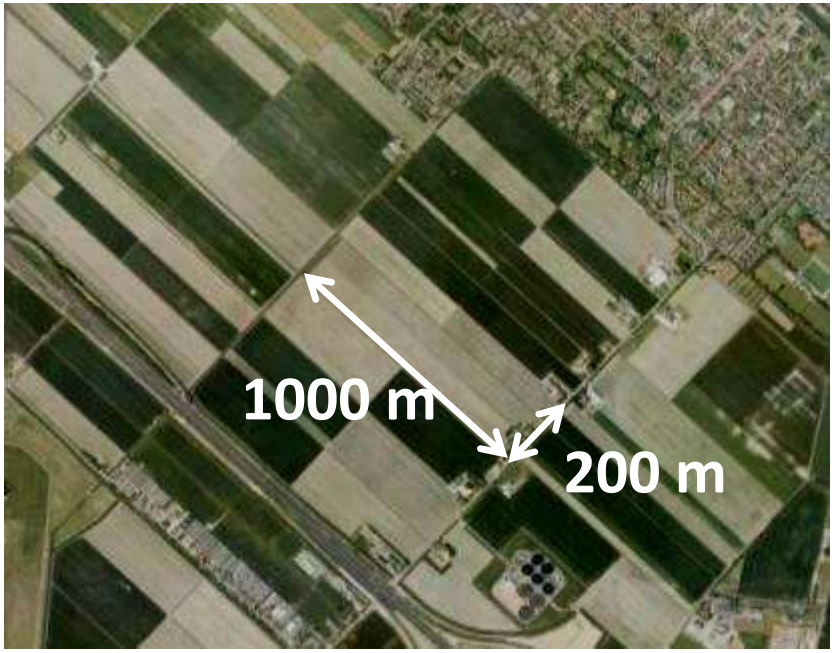


Hachirogata



Haarlemmermeer

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Hachirogata

- Reclaimed lake
- 17 000 ha
- 52 km dike
- 1963-1966
- -5.0 m MSL
- Arable land (paddy)

Haarlemmermeer

- Reclaimed lake
- 18 500 ha
- 62 km dike
- 1849-1852
- - 4.5m MSL
- Arable land (cereals)

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Involving people

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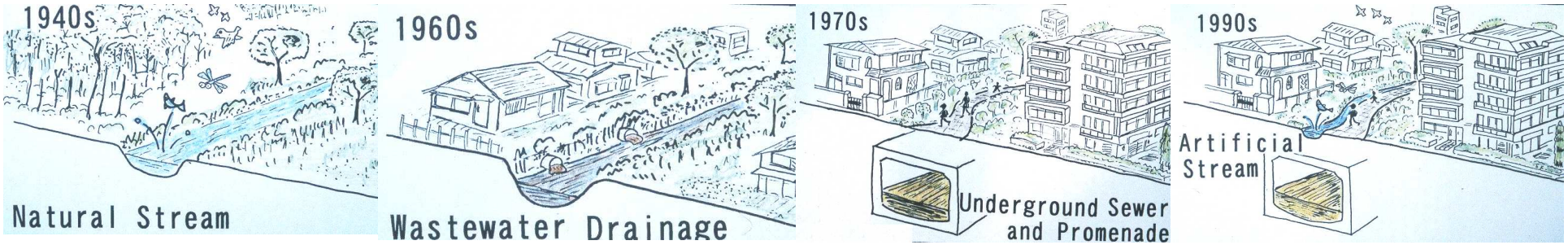
Involving people: Kitazawa River



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Involving people: Kitazawa River

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Communication

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Lessons from cooperation

- Disasters can not always be prevented, work to improve coping capacity
- Water innovation starts with small scale implementation in practice
- A city is made for people, involve people
- Uncertainty requires the strengthening of the capacity to adapt
- Long term planning is crucial

Acknowledgements

This presentation was possible by the data, support and illustrations of:

- Ministerie van Verkeer en Waterstaat
- Netherlands Water Partnership
- Ministry of Land, Infrastructure and Transportation
- National Institute of Land and Infrastructure Management
- Arakawa River Office
- Japan Institute of Construction Engineering
- Tokyo Metropolitan Government
- Hosei University
- Nagaoka University
- Shibaura Institute of Technology
- Tokyo engineering consultants
- Takenaka Construction Corporation
- Ariake Wastewater treatment plant
- University of Tokyo
- Saga University
- Institute of Lowland Technology
- Jobaru River Commission
- The Netherlands Embassy in Japan

Ministerie van Verkeer en Waterstaat

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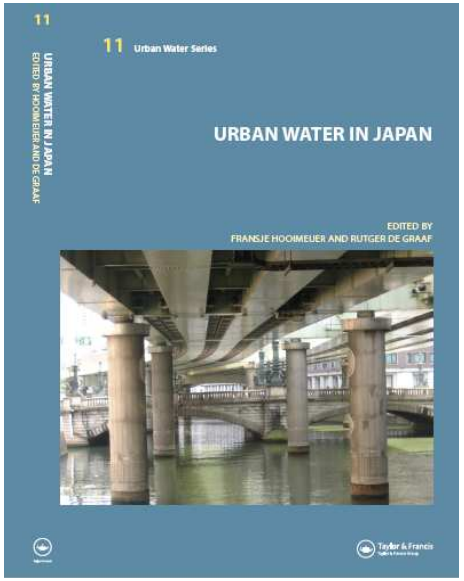
Questions



r.e.degraaf@tudelft.nl

Book order:
http://www.routledge.com/books/series/Urban_Water_Series

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Changing the urban watercycle, innovative approaches from Australia

Rutger de Graaf
PhD student Urban Water Management

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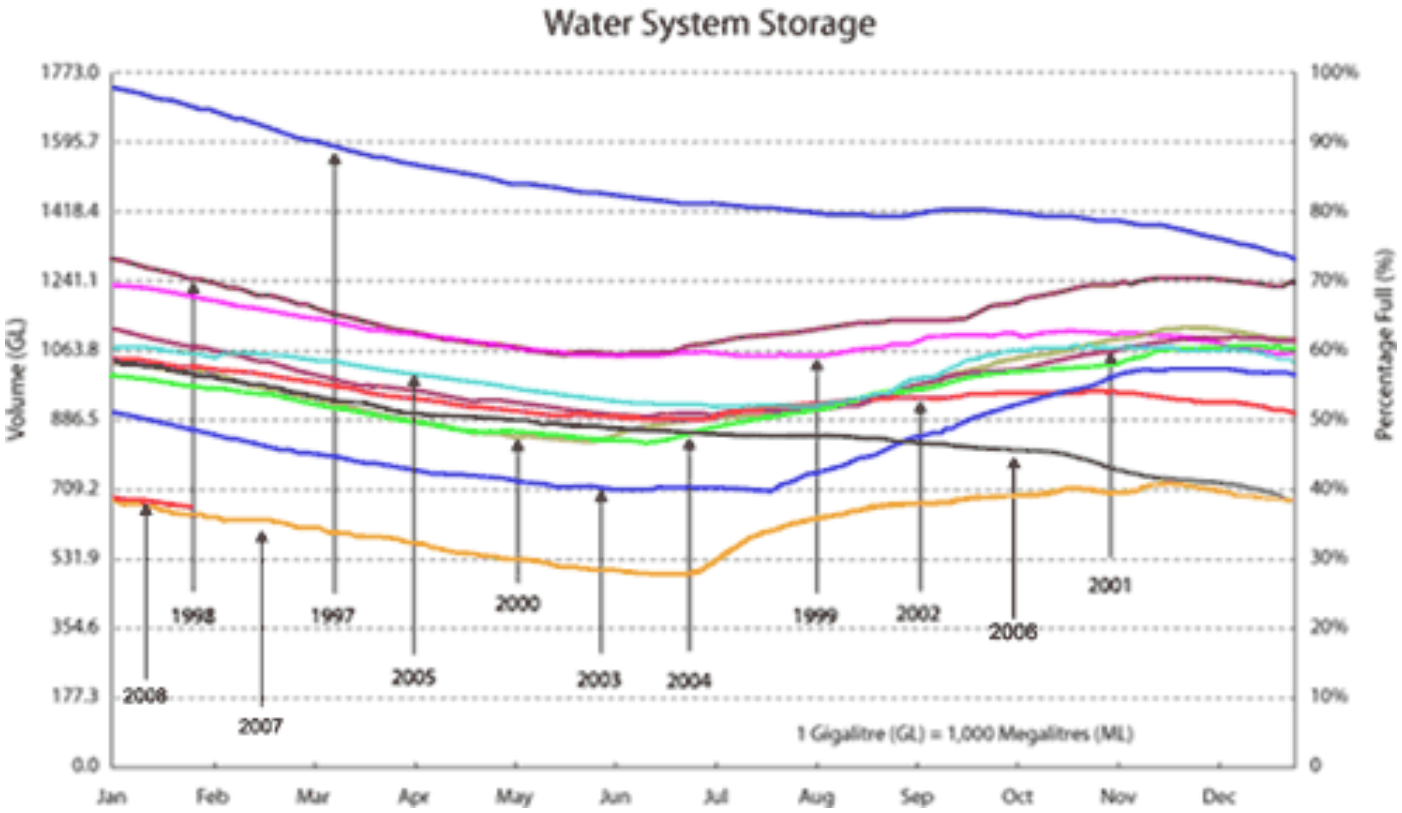
Water Shortage



Source: http://www.melbournewater.com.au/content/water/weekly_water_update/weekly_water_update.asp

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Water Shortage

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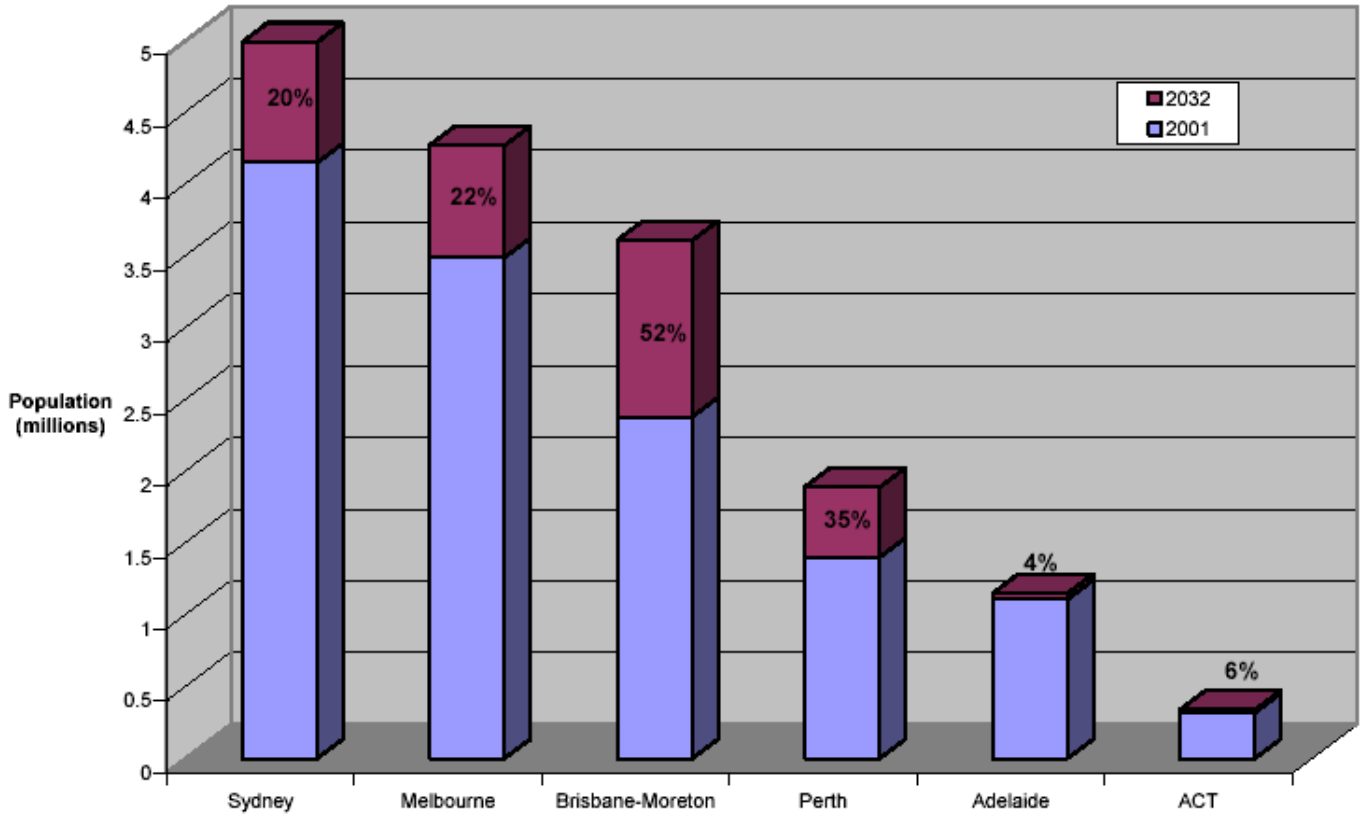
Water use projections 2032



Source: Jasper Verberk

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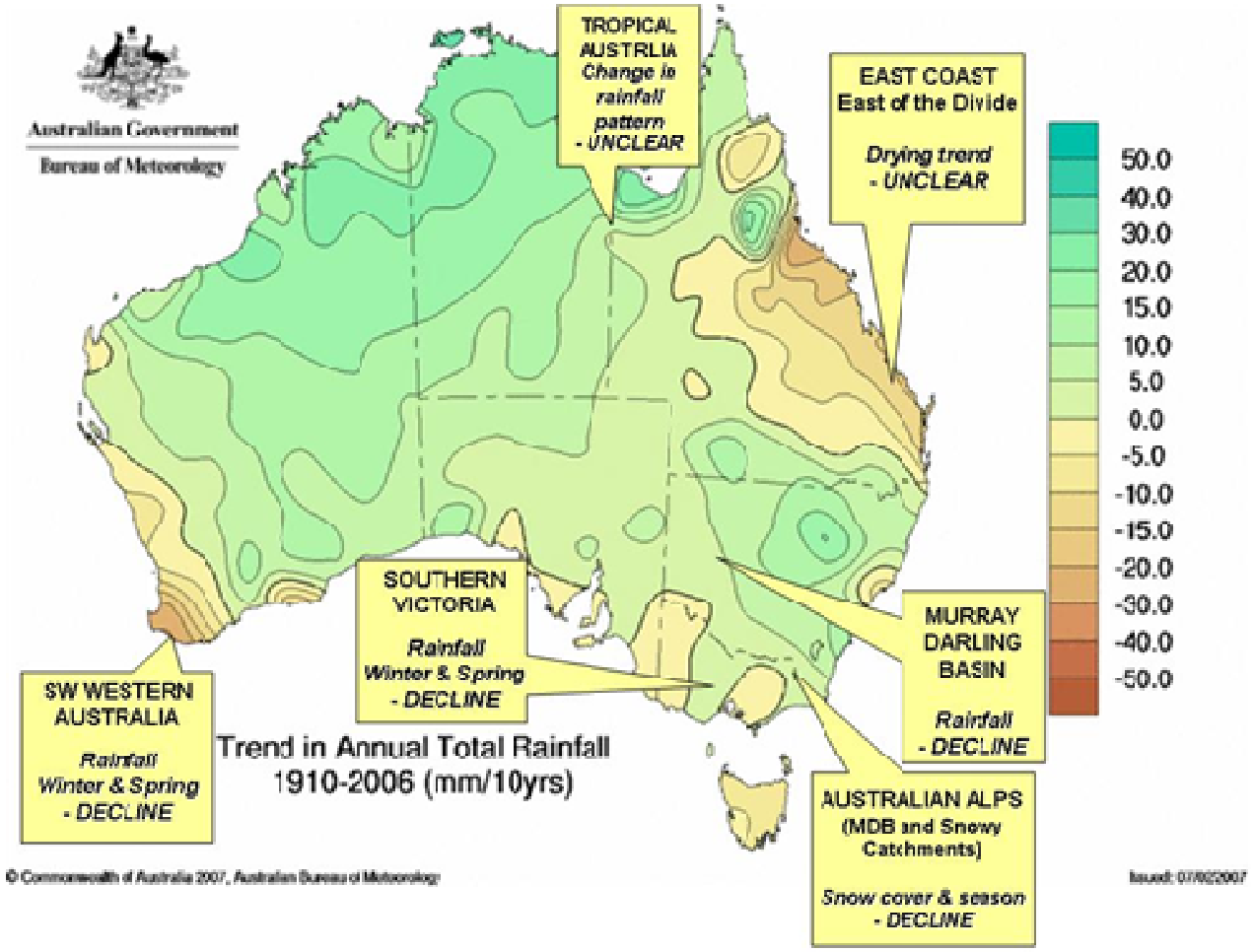
Trends: Climate Change



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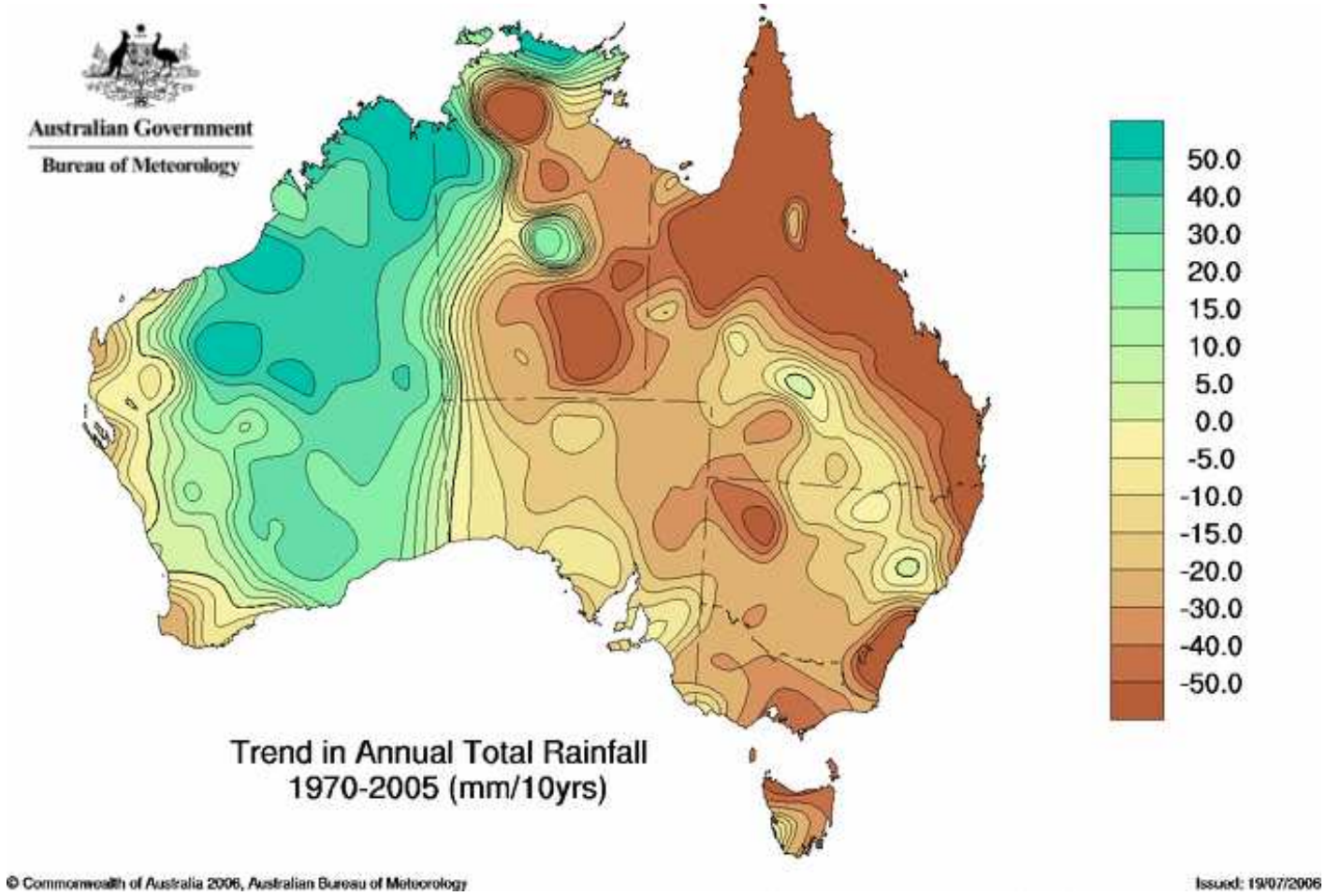
Trends: Climate Change



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Trends: Urbanisation

- **Example Melbourne**
  - Current population : 3,6 million
  - Project increase up to 2030: 1,0 million
  - Low building density : 5-15 dwellings/ha

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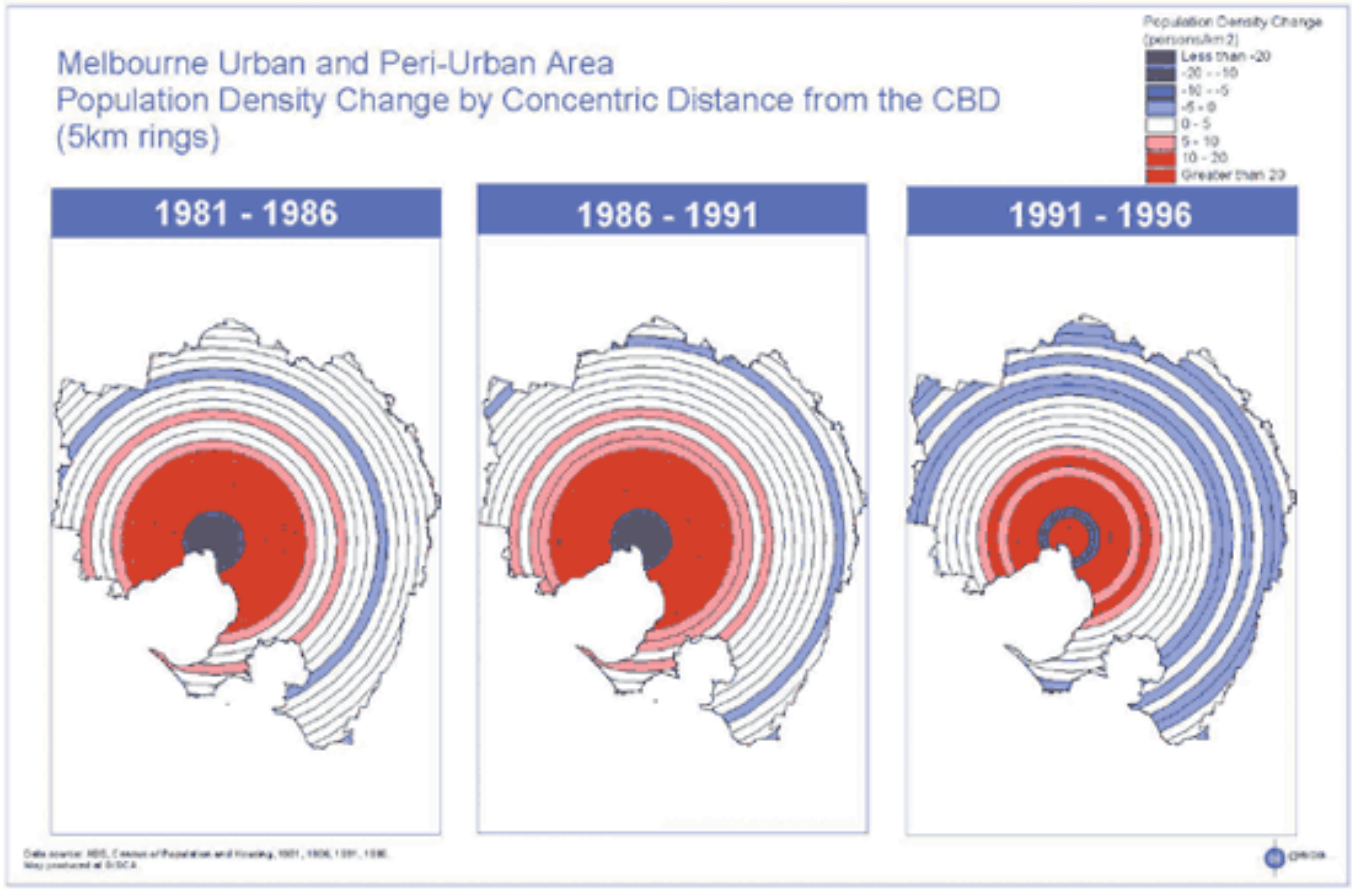
Urban sprawl



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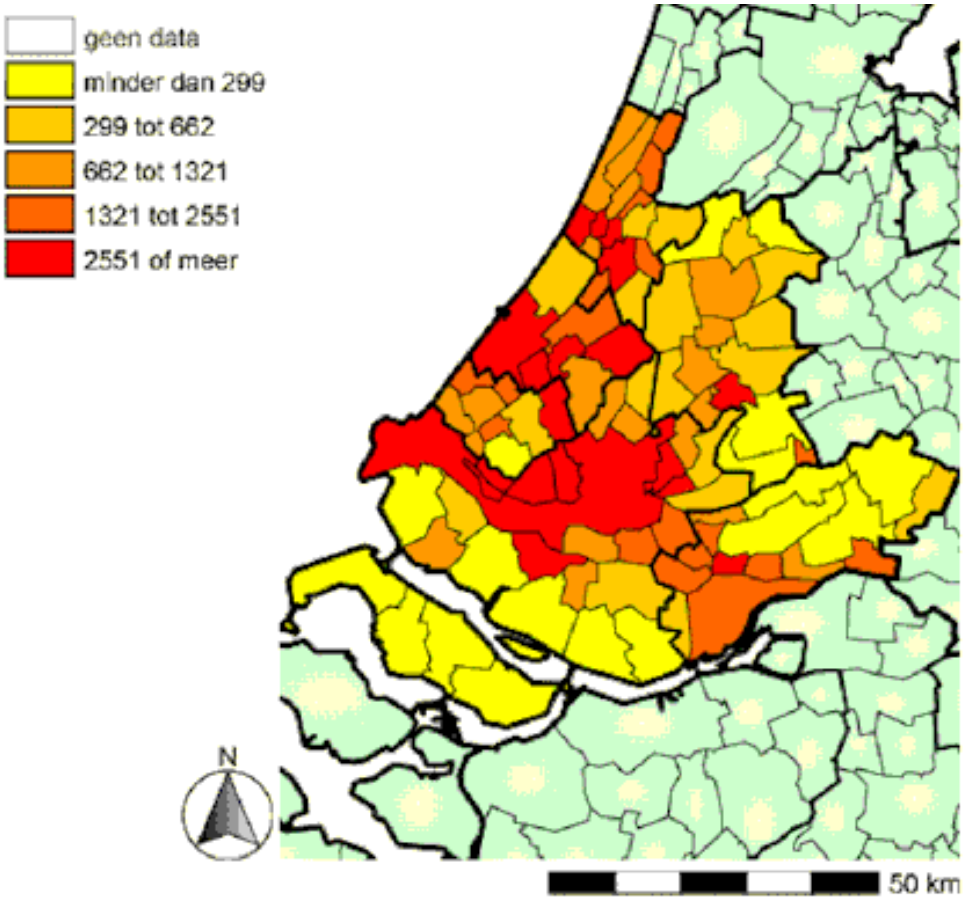
2030 growth areas



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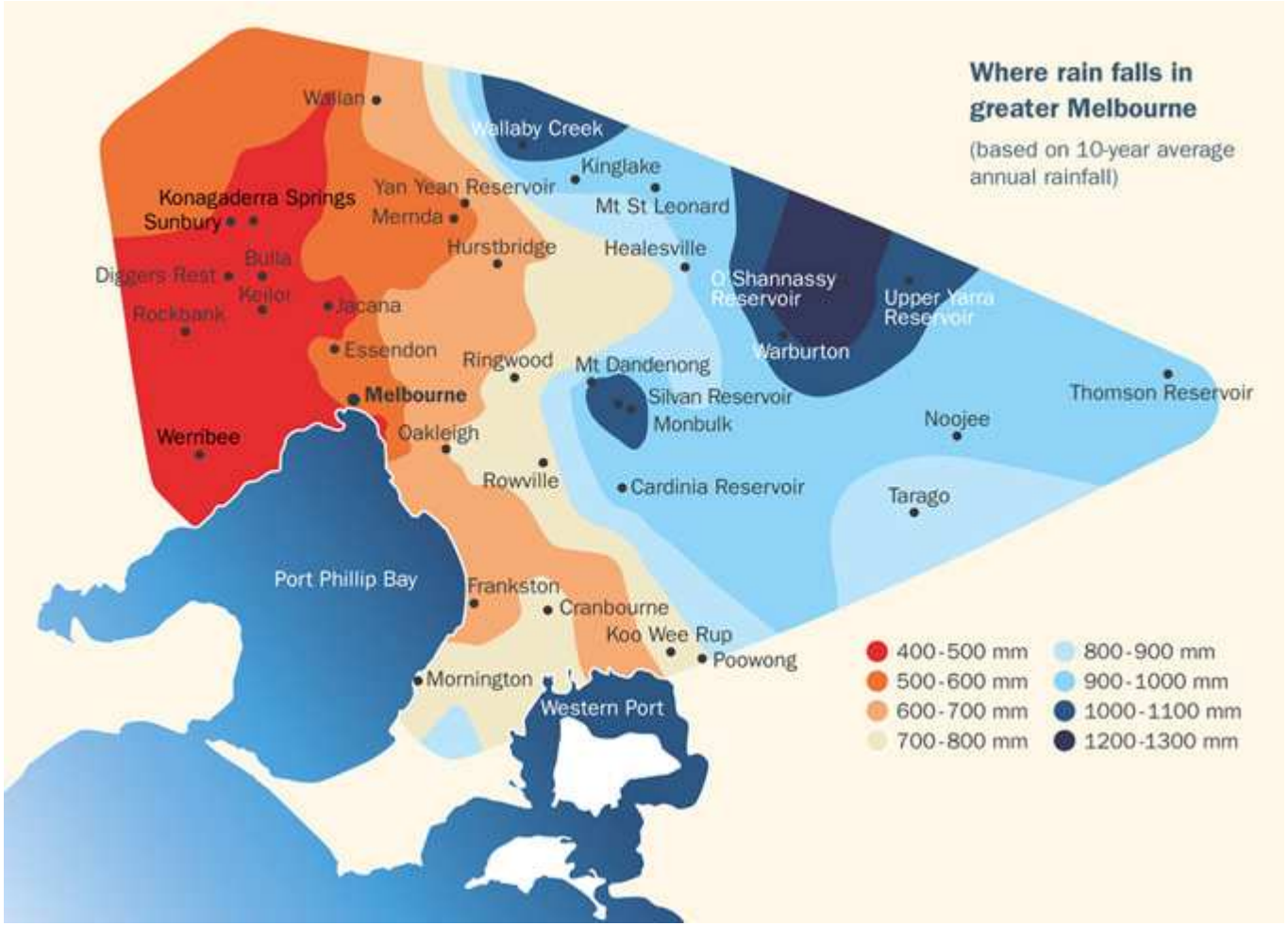
Rainfall Data



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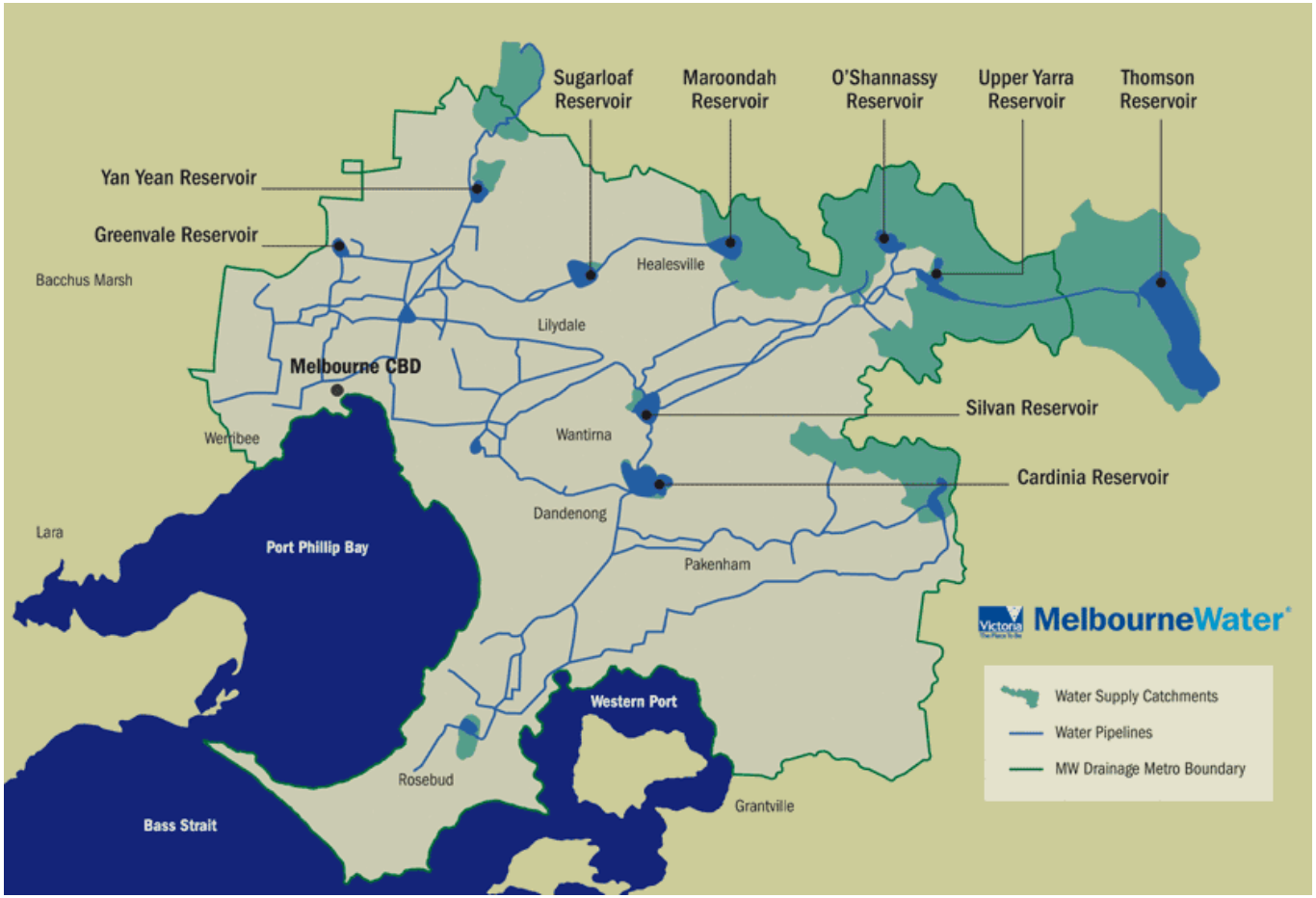
Water supply catchments



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Water supply catchments

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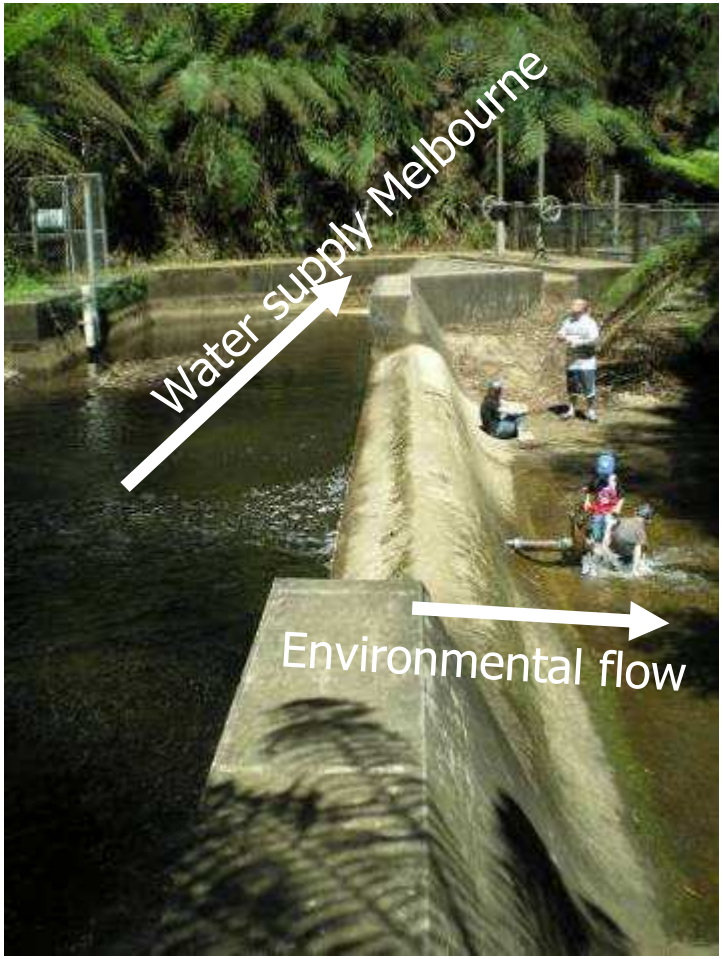
Water supply catchments



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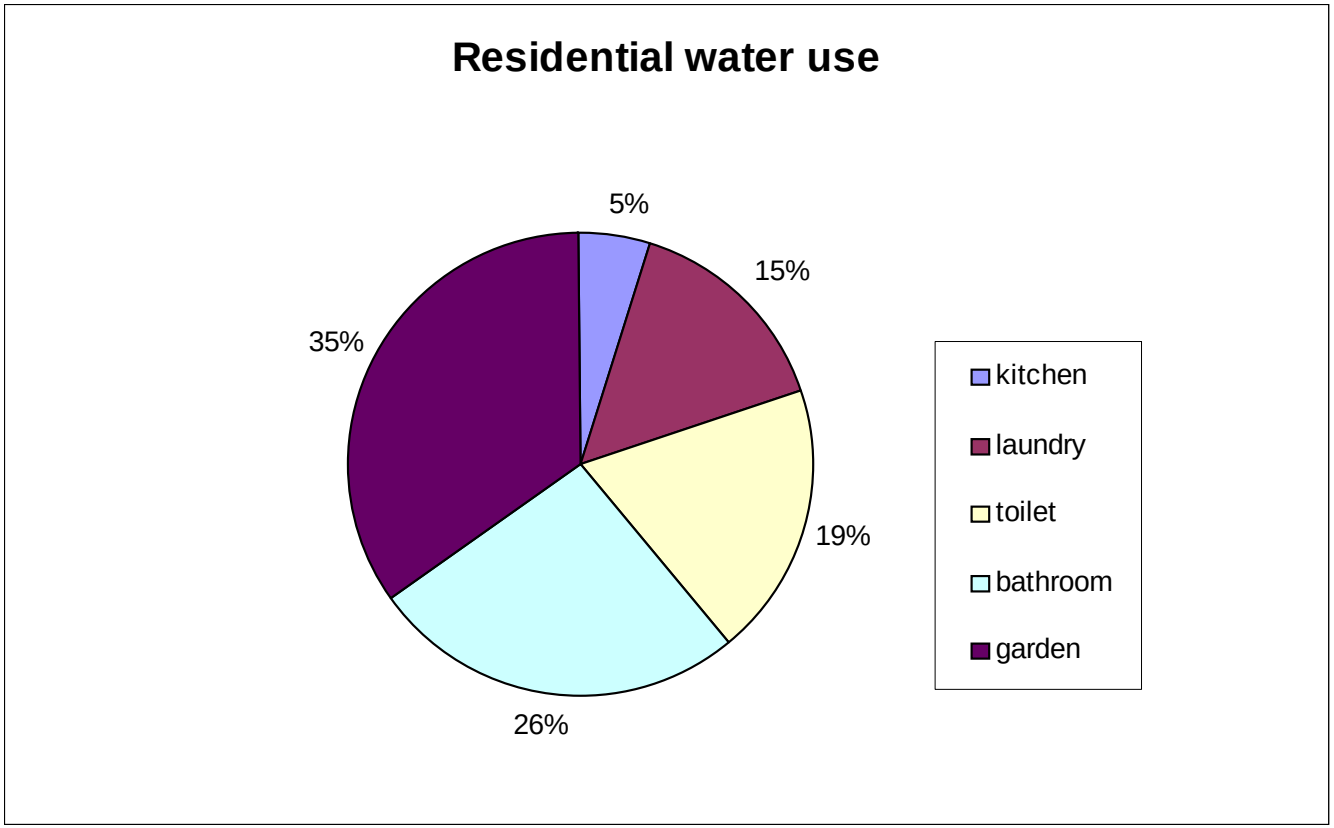
Residential water use



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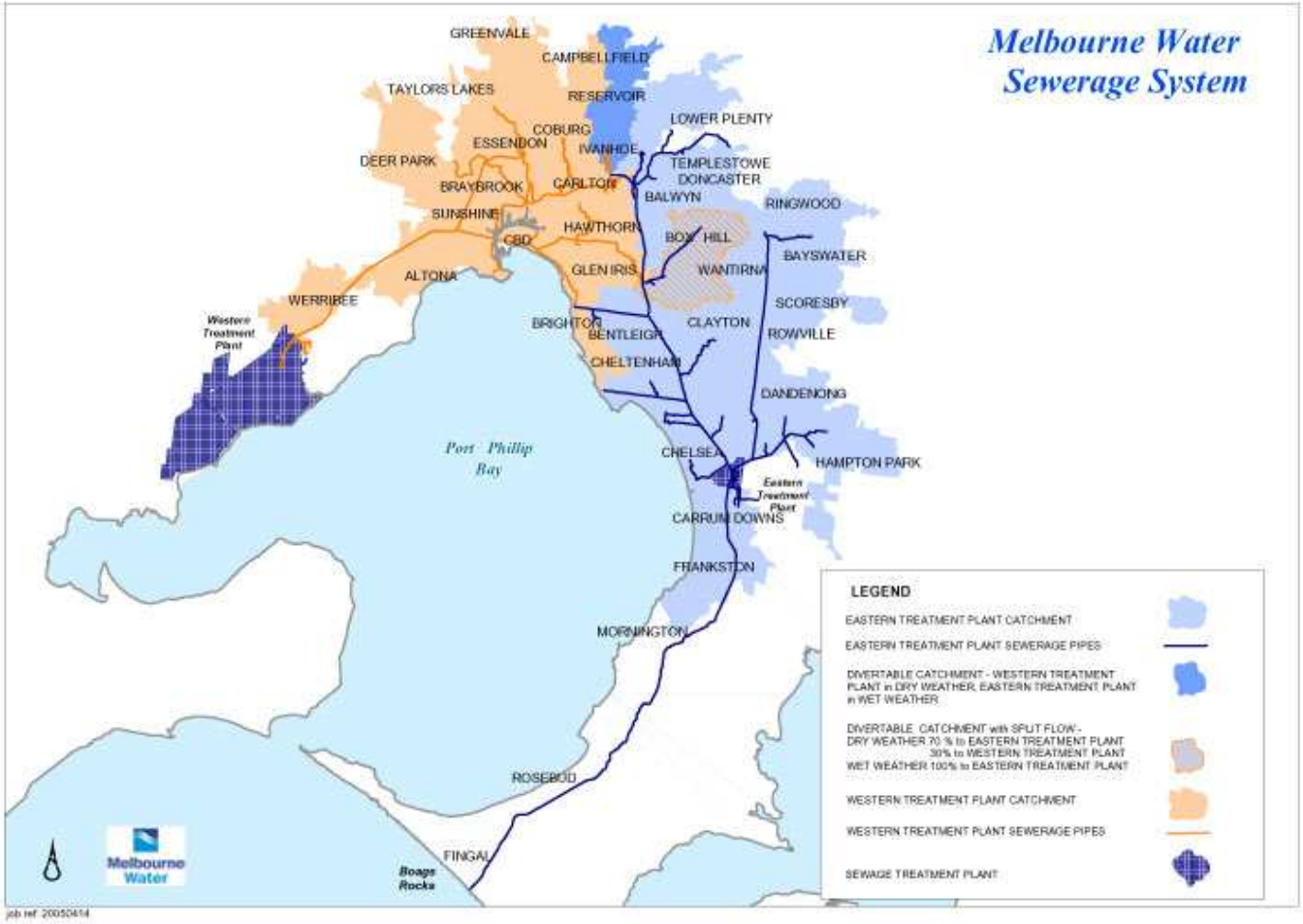
Sewer system



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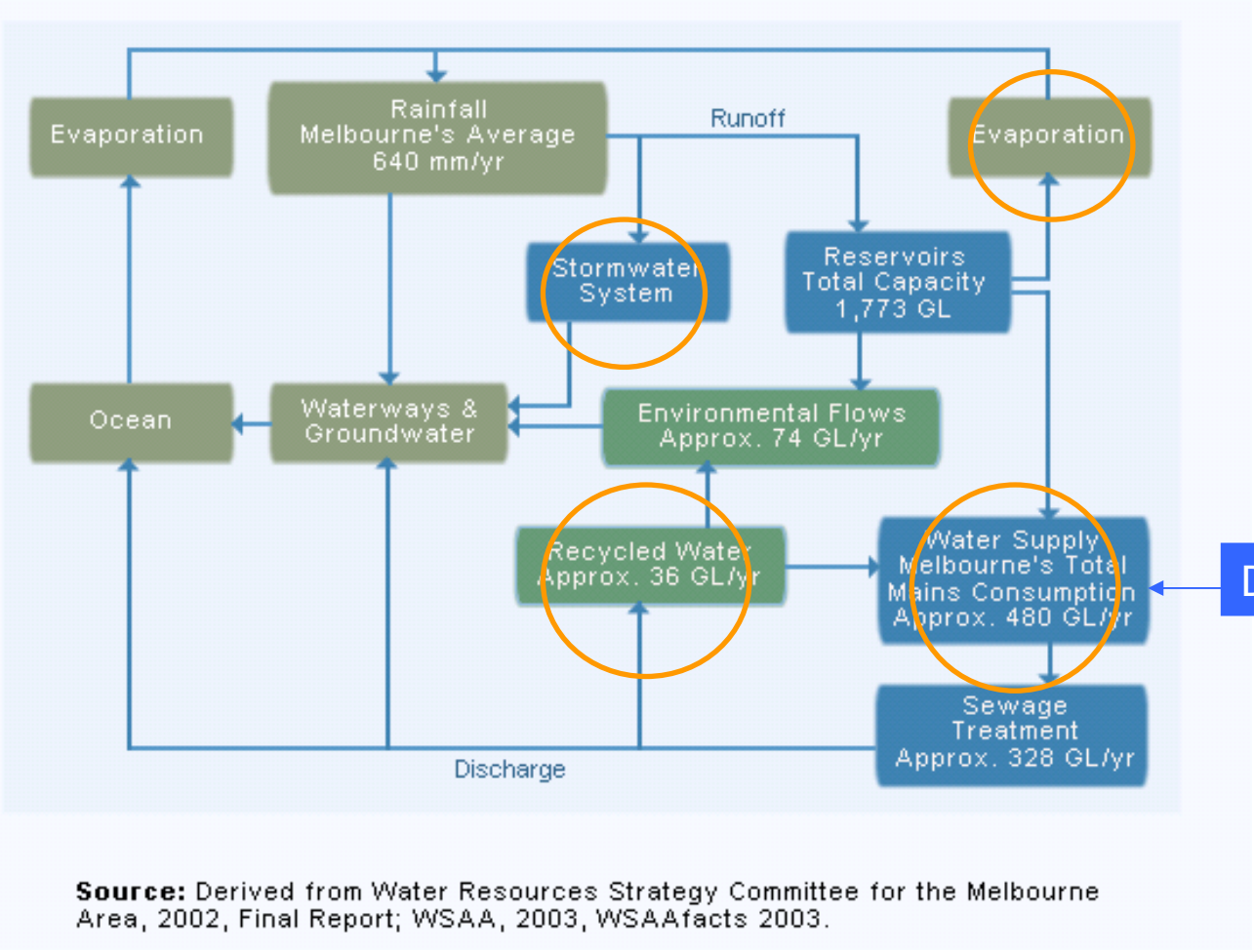
The urban water cycle



Source: Derived from Water Resources Strategy Committee for the Melbourne Area, 2002, Final Report; WSAA, 2003, WSAAfacts 2003.

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How to change the urban water cycle?

- Stormwater harvesting
- Water recycling
- Prevent Evaporation
- Demand management

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Stormwater management

Conventional approach

Source: Mike Mouritz
Susan van de Meene

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Stormwater management

Innovative approach

Source: Mike Mouritz

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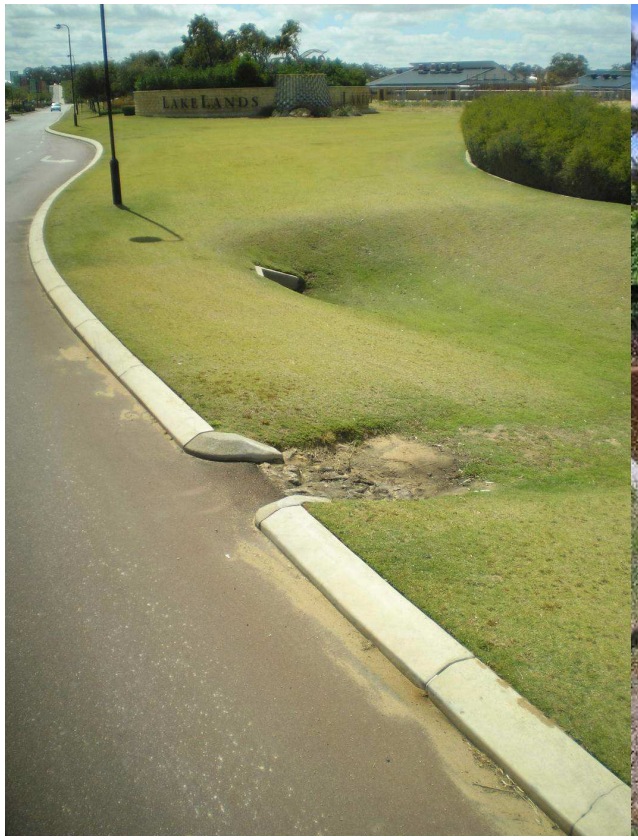
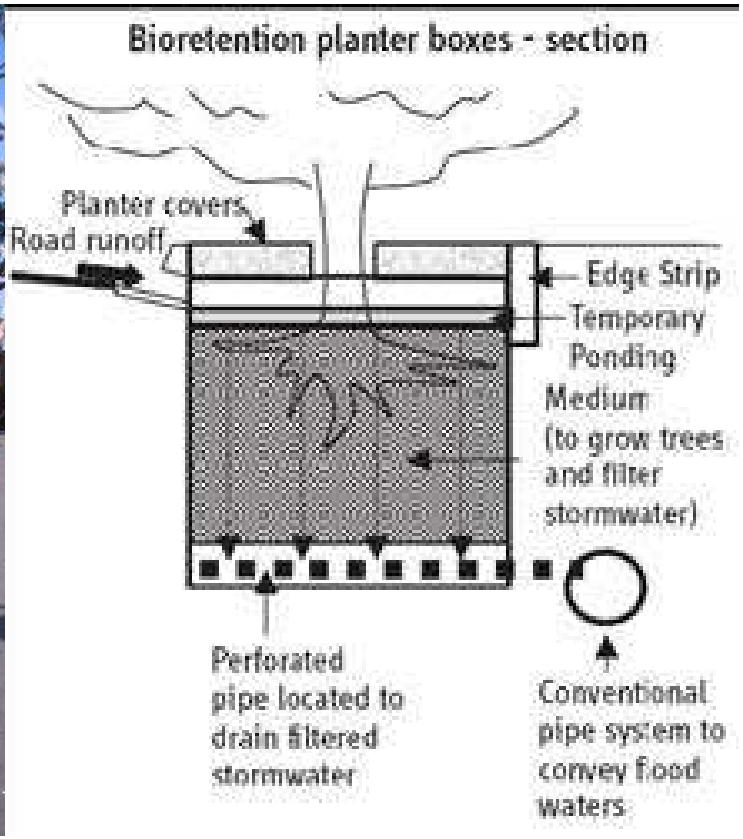
Stormwater management





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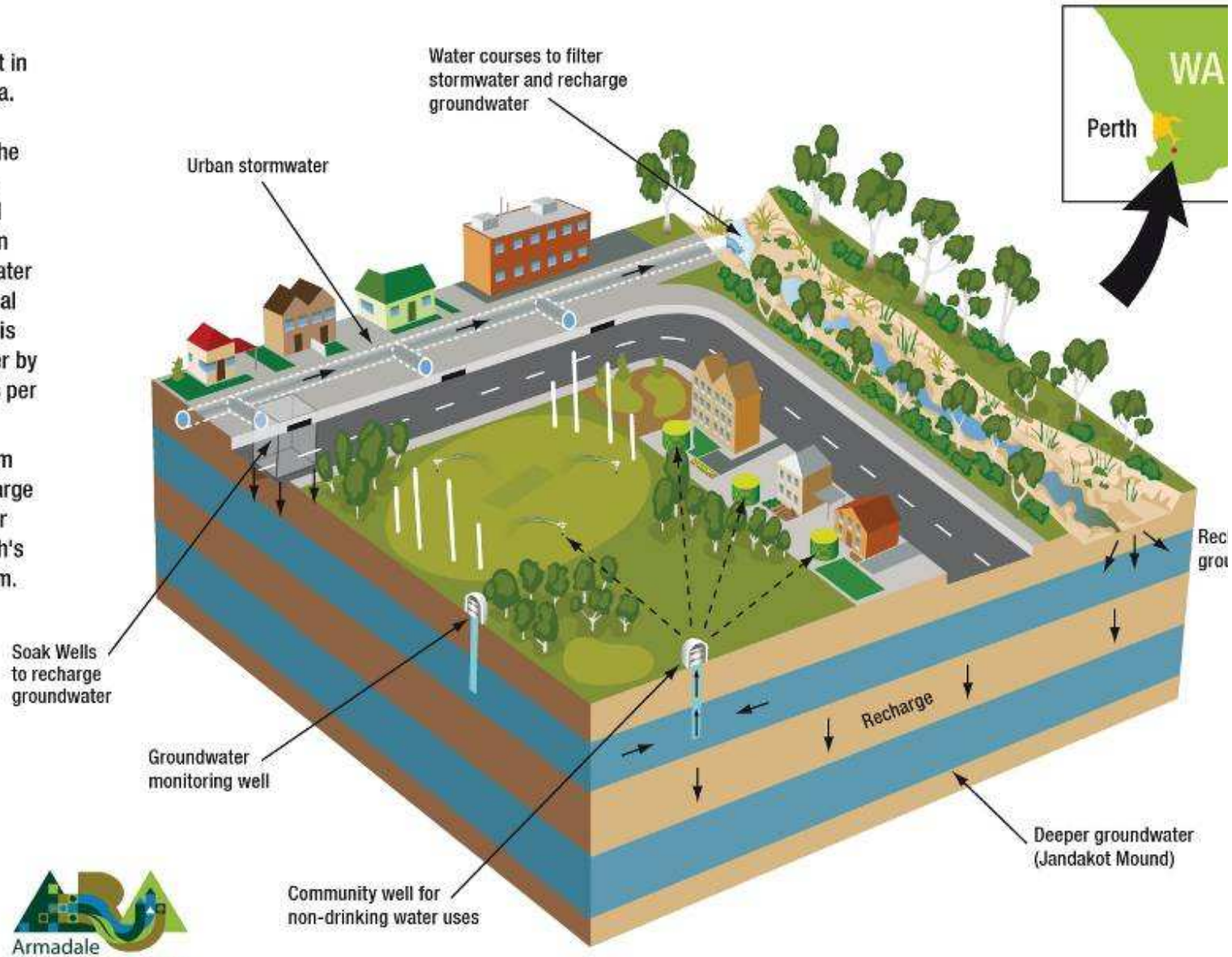
Brookdale Water Cycle Project

The project involves water sensitive urban development in the Brookdale/Wungong area. Stormwater from the new development will recharge the groundwater through water courses and soak wells, and community bores rather than private bores will provide water for community and residential non-drinking water uses. This will substitute drinking water by approximately 2 billion litres per year.

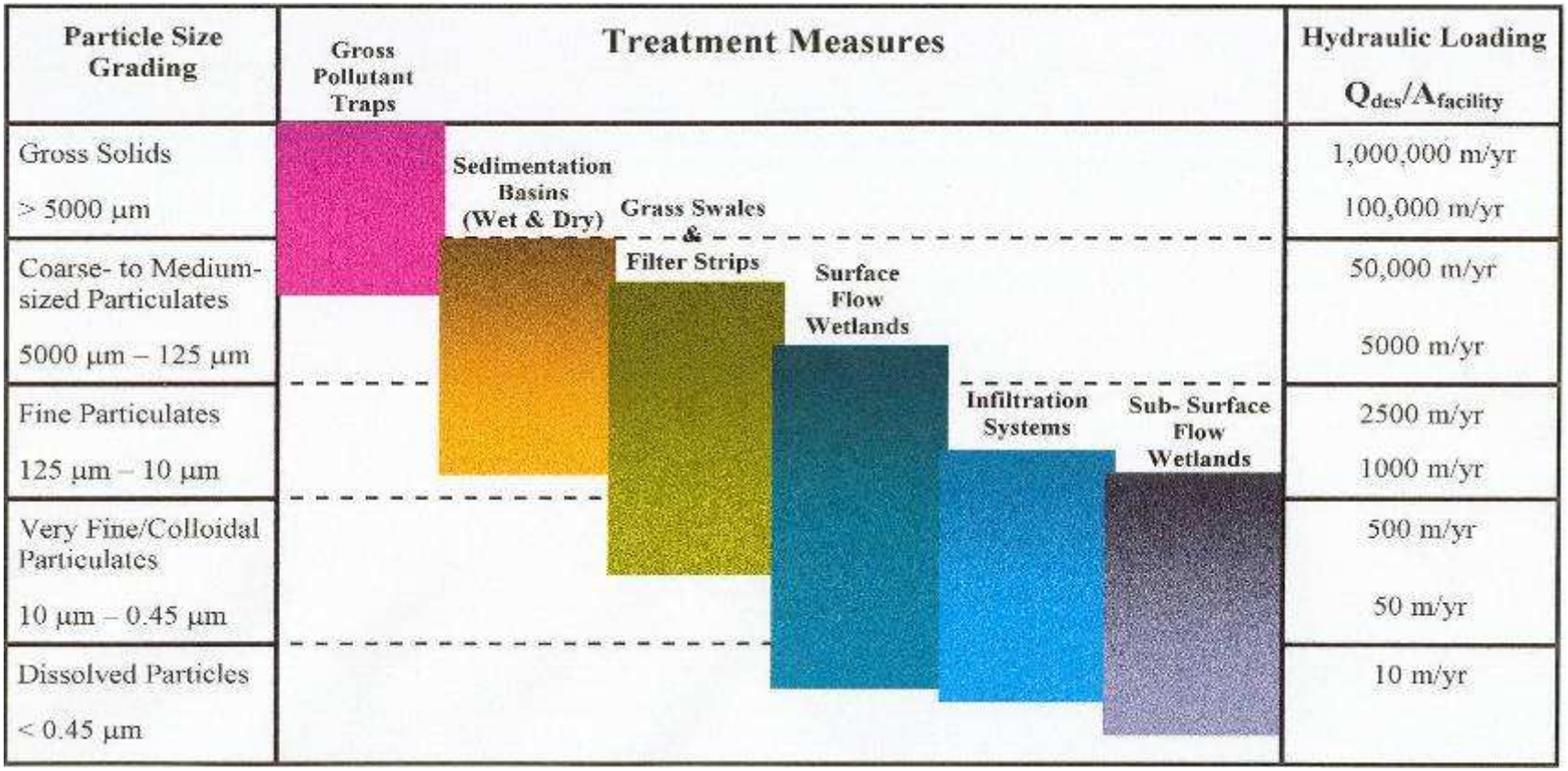
Additionally, stormwater from the region will provide recharge to the Jandakot groundwater mound which is part of Perth's drinking water supply system.



Australian Government
National Water Commission

Armadale Redevelopment Authority

Stormwater management



Source: Tony Wong

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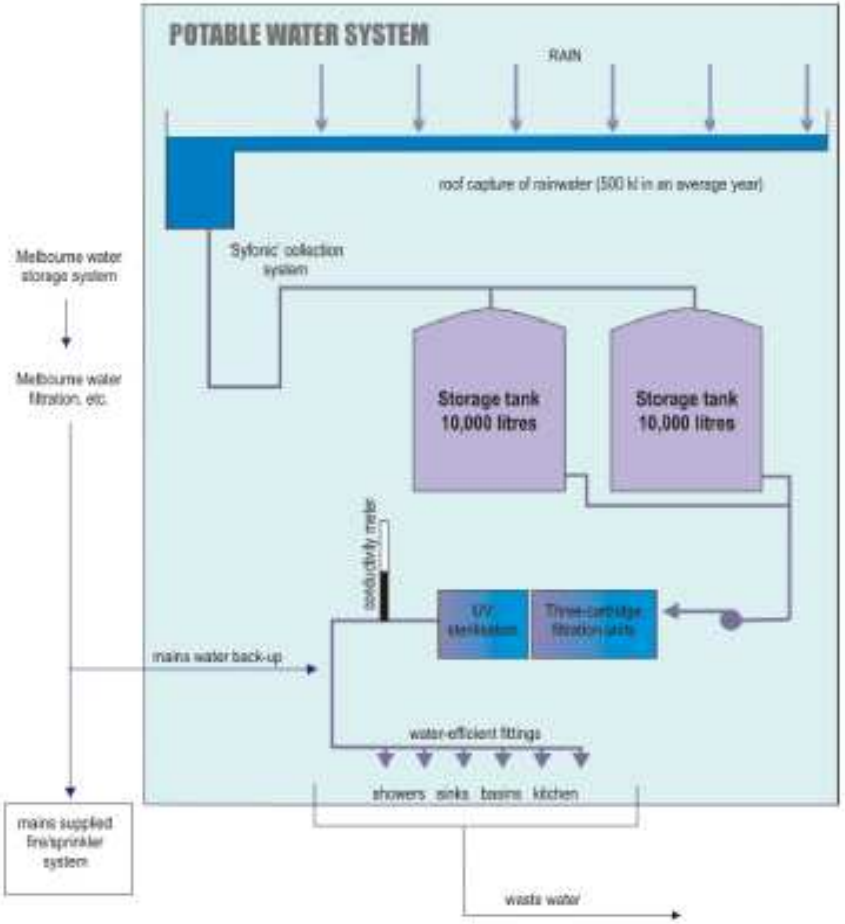
Stormwater harvesting



Greywater recycling

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Wastewater recycling

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Wastewater recycling

Source: Jeroen Rijke

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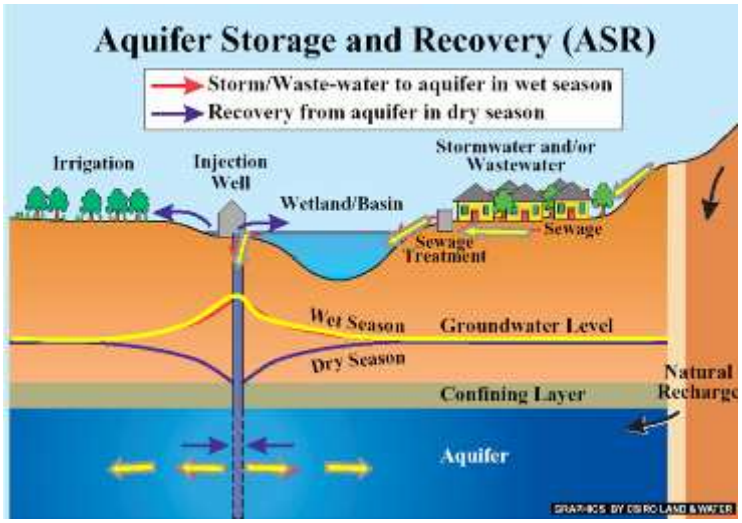
Prevent evaporation



Potential Evaporation in Melbourne is: 1200 mm

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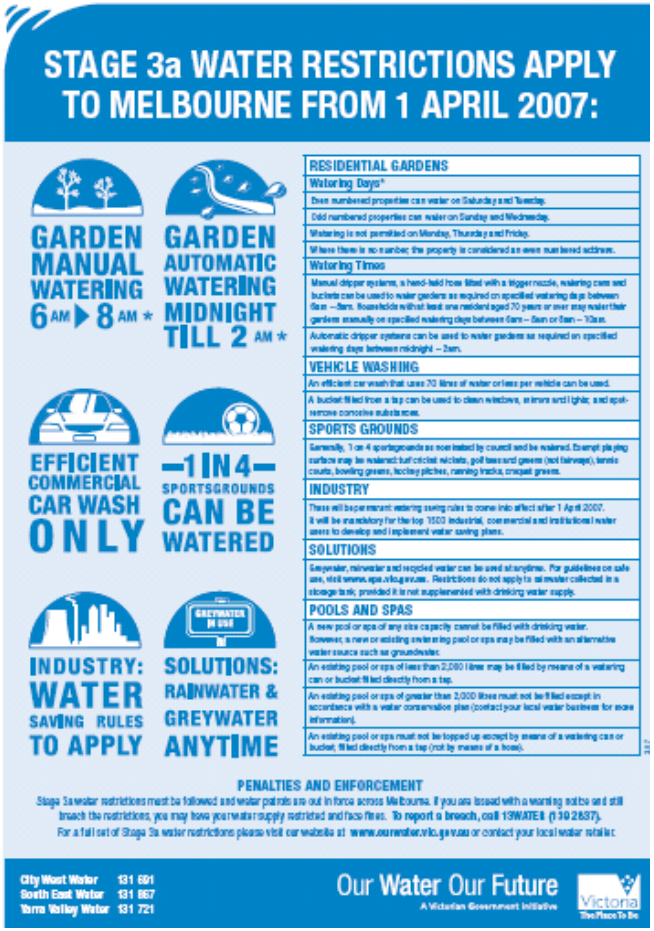
Demand management



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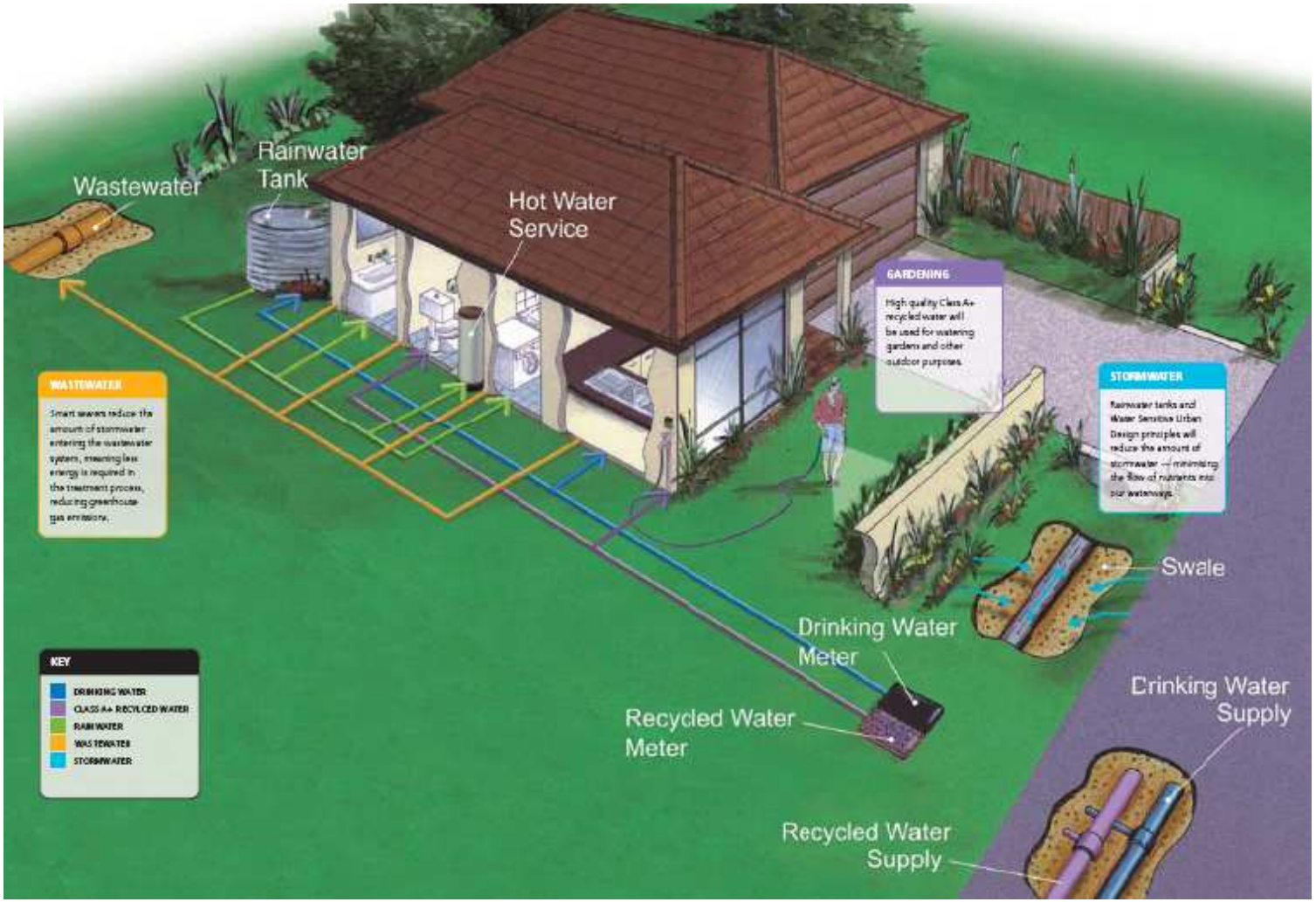
Demand management



Source: Goldcoast water

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Exploring the technical and economic feasibility of using the urban water system as a sustainable energy source

Presenter:
Rutger de Graaf - Delft University of Technology, the Netherlands

Co-authors:
Frans van de Ven, Ivo Miltenburg - Delft University of Technology
Bert van Ee, Lucas van de Winckel - Tauw
Gijs van Wijk - Ecofys

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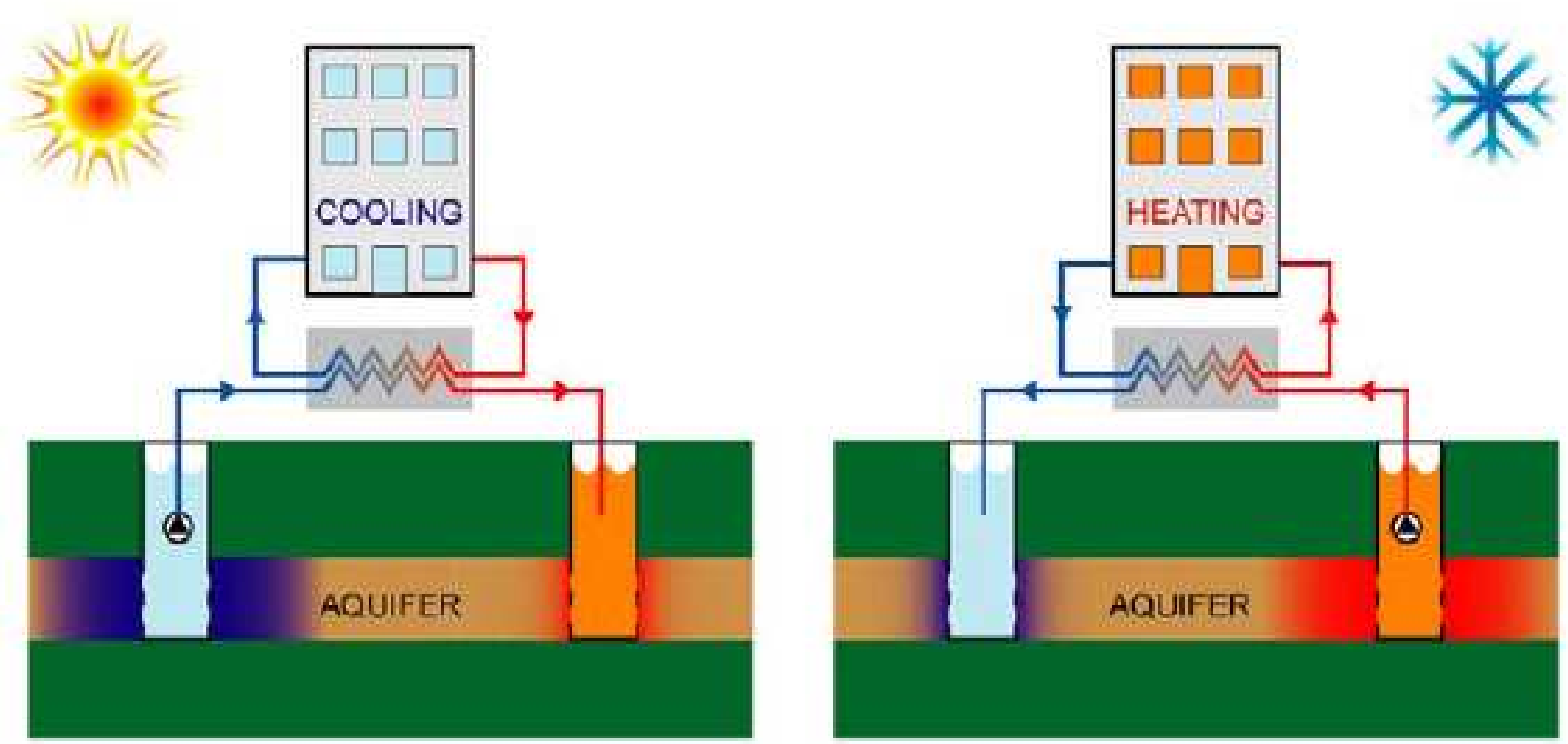
Aquifer Thermal Energy Storage (ATES)



Source: IAE, 2005

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Aquifer Thermal Energy Storage (ATES)

Characteristics:

- Already more than 300 projects in the Netherlands
- High level of comfort
- High CO_2 reduction

However:

- Long term heat equilibrium in aquifer is required
- Heat demand should be approximately the same als cooling demand over a long period.
- This is not the case for residential areas

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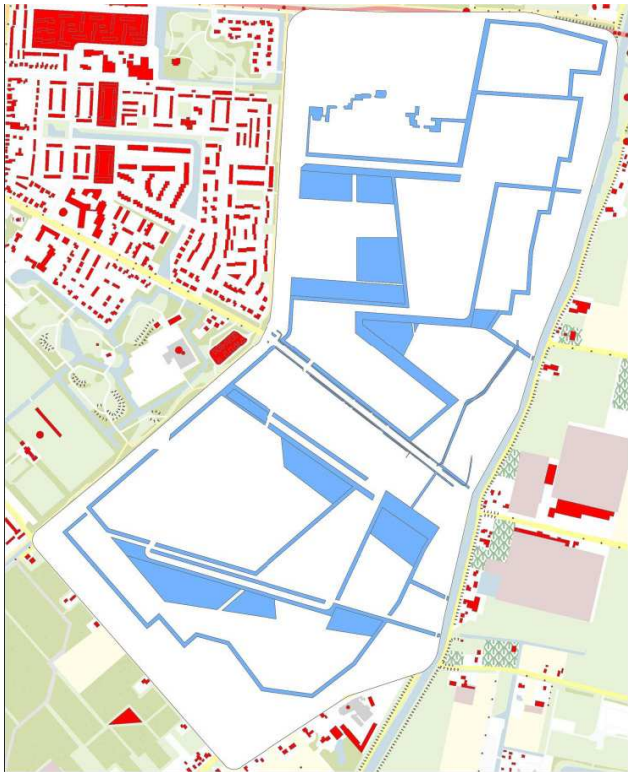
New urban development in Heerhugowaard

- 2816 houses
- 150 hectares plan area
- 20.7 hectares surface water
- High ambition to realize sustainable energy supply



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Research questions

- Is it possible to regenerate the aquifer with heat from the surface water system and make ATES possible in residential areas?
  - What are the effects on the water system?
  - What are the costs?
  - What is the effectiveness for CO_2 reduction compared to a conventional system of natural gased based central heating system?

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Heat requirements

Heating requirements are calculated to estimate heat shortage in aquifer if ATES is applied in this urban development

Heat demand	106,000	GJ/year
Cooling demand	21,000	GJ/year
Shortage	**85,000**	**GJ/year**

This amount will have to be extracted from surface water

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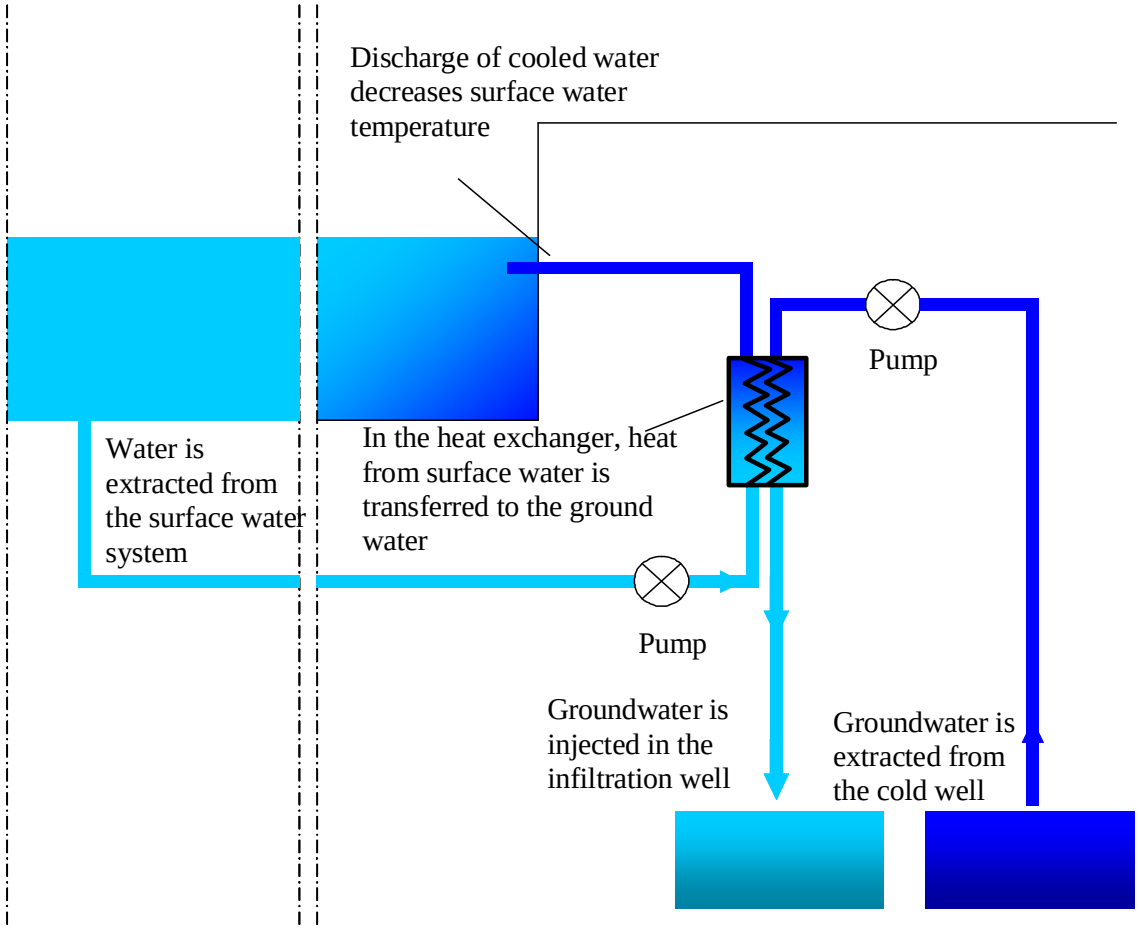
The ATES+ concept



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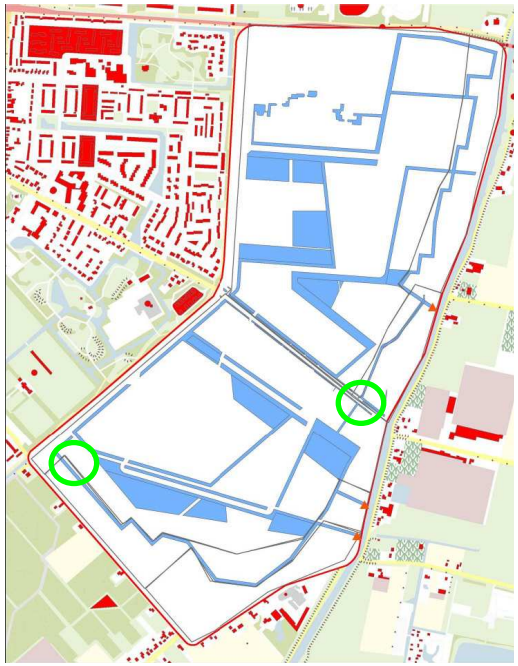
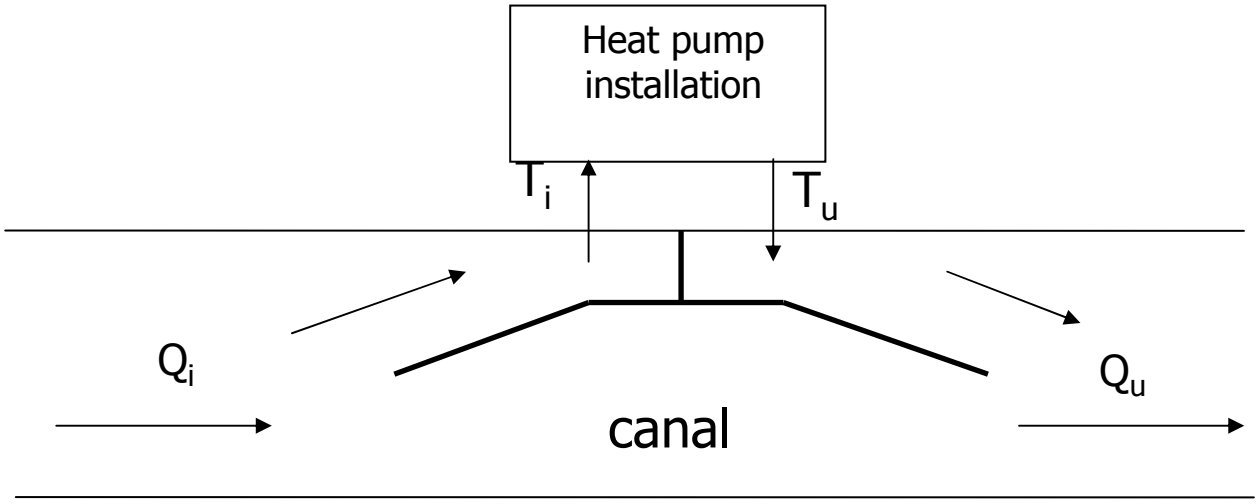
Effects on surface water system

- In three summer months we will extract 85,000 GJ
- What will be the influence on temperature and quality?





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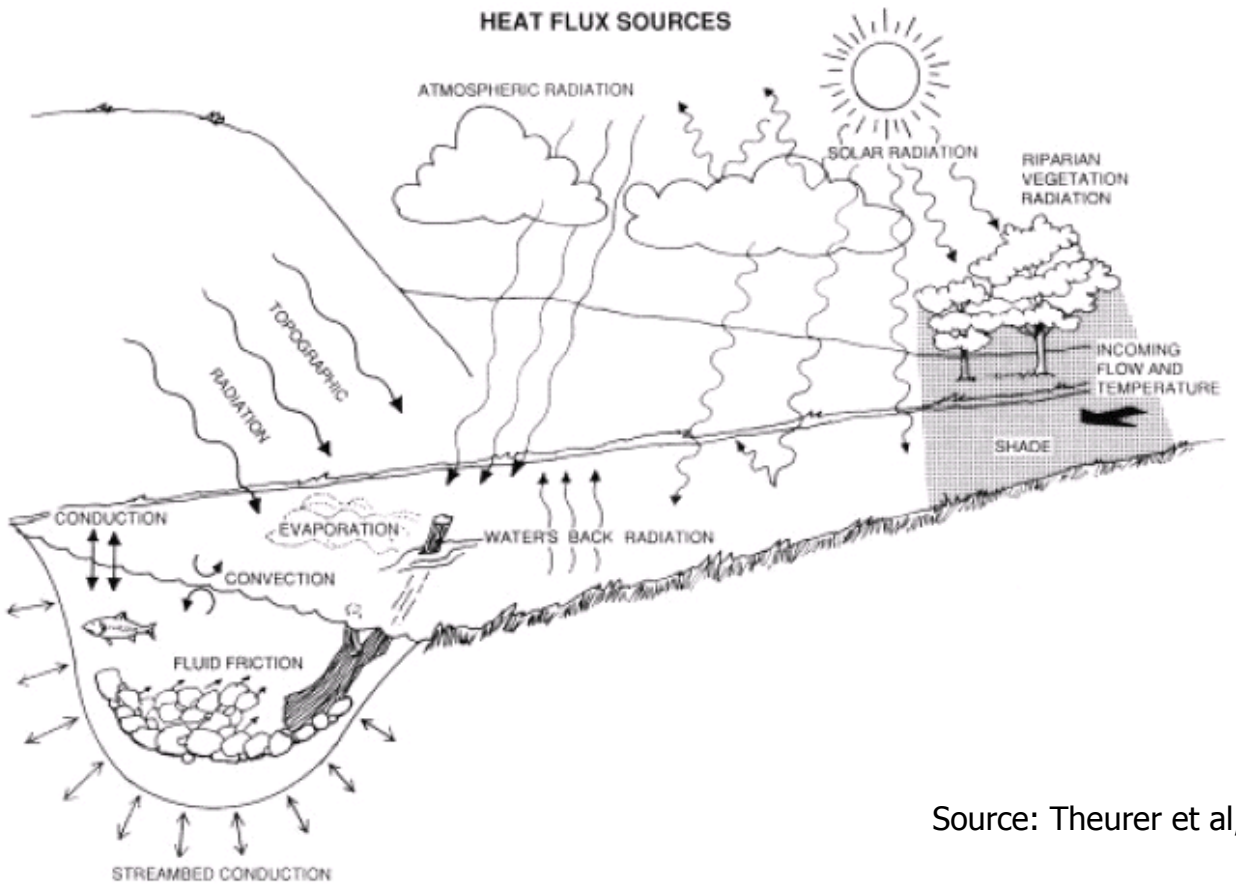
Heat balance surface water system



Source: Theurer et al, 1984

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Heat balance surface water system

Results:

		June	July	August
Solar radiation	W/m^2	203.3	193.9	166.5
Atmospherical radiation	W/m^2	312.3	337.7	338.4
Lake radiation	W/m^2	-378.0	-392.8	-388.5
Evaporation	W/m^2	-75.7	-77.8	-62.8
Conduction	W/m^2	-6.42	-7.61	0.88
Heat extraction	W/m^2	-52.9	-52.9	-52.9
Temperature decrease	**°C**	**1.6**	**1.5**	**1.6**

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Economic Feasibility

- Compare conventional system (CS) with ATES+

Per house (Euros)	**CS**	**ATES+**
Investments	4,600	8,100
Exploitation costs per year	850	500

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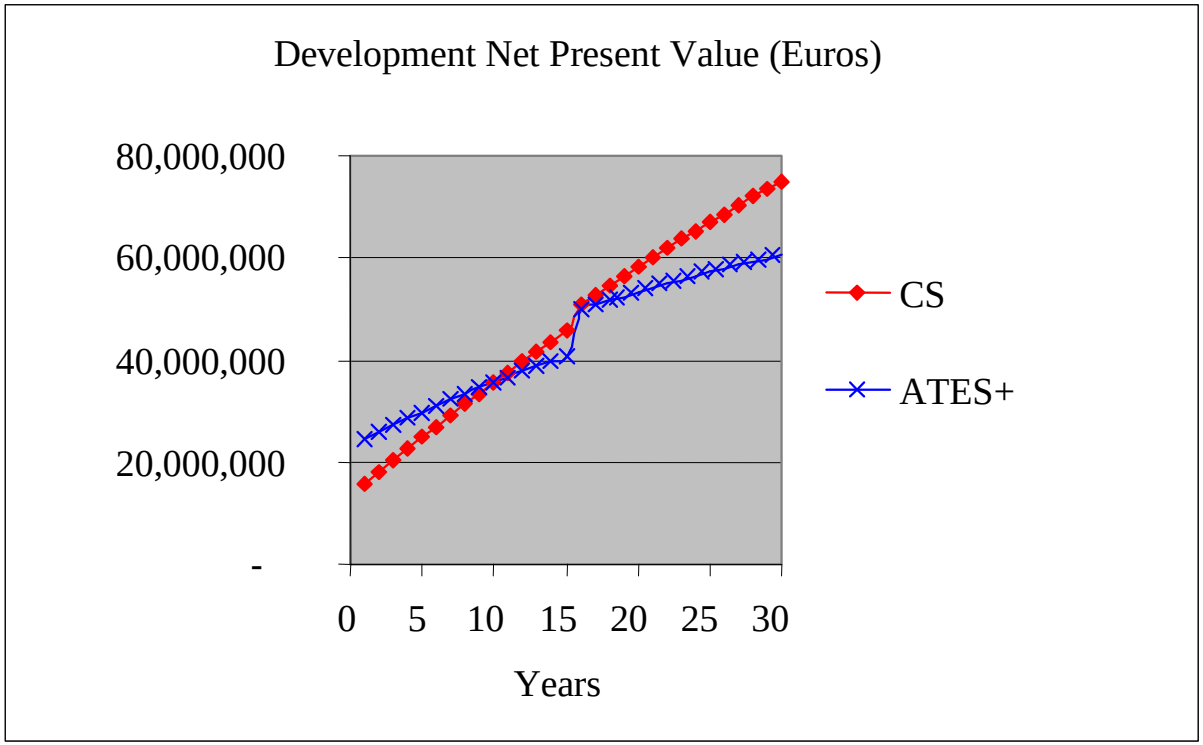
Economic Feasibility

- Net present value



- IRR= 15%

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Conclusions

- The urban water system is a huge, largely unused source of sustainable energy
- With ATES+ no natural gas supply is needed anymore in the urban development, however electricity remains necessary to operate the system
- CO_2 reduction is 60% compared to CS
- Temperature decrease of 1.5 degrees will have benefits for water quality and mitigates effects of climate change
- Concept is applicable elsewhere in areas with aquifers such as alluvial and coastal plains where surface water is near

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Local water sources: Rainwater harvesting

- Model calculation based on time series 1906-2003
- Three critical years selected
  - Average year
  - Dry year (2003)
  - Very dry year (1921)

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Results: Water Demand Reduction

	Average year	Extremely dry year	Dry year
Scenario a	27%	15%	23%
Scenario b	16%	8%	13%

Floating Urbanization in the Netherlands


Dura Vermeer, Maasbommel 2006


Recreatiegebied Oolderhuuske 199


Zaaijer, Ijburg 2006


Attika, IJburg 2007


Terwijde Utrecht 2008

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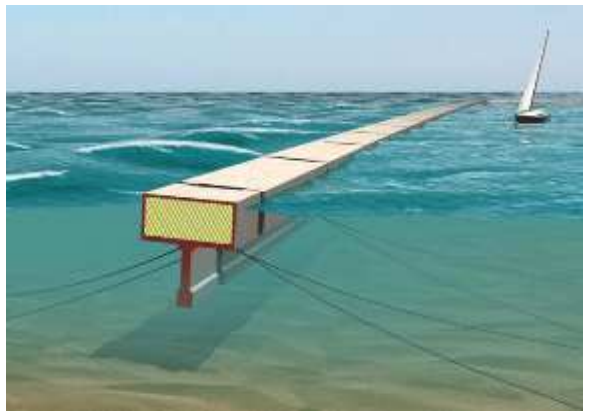
Floating Urbanization in the Netherlands





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Floating structure technology

Movie Ties Rijcken

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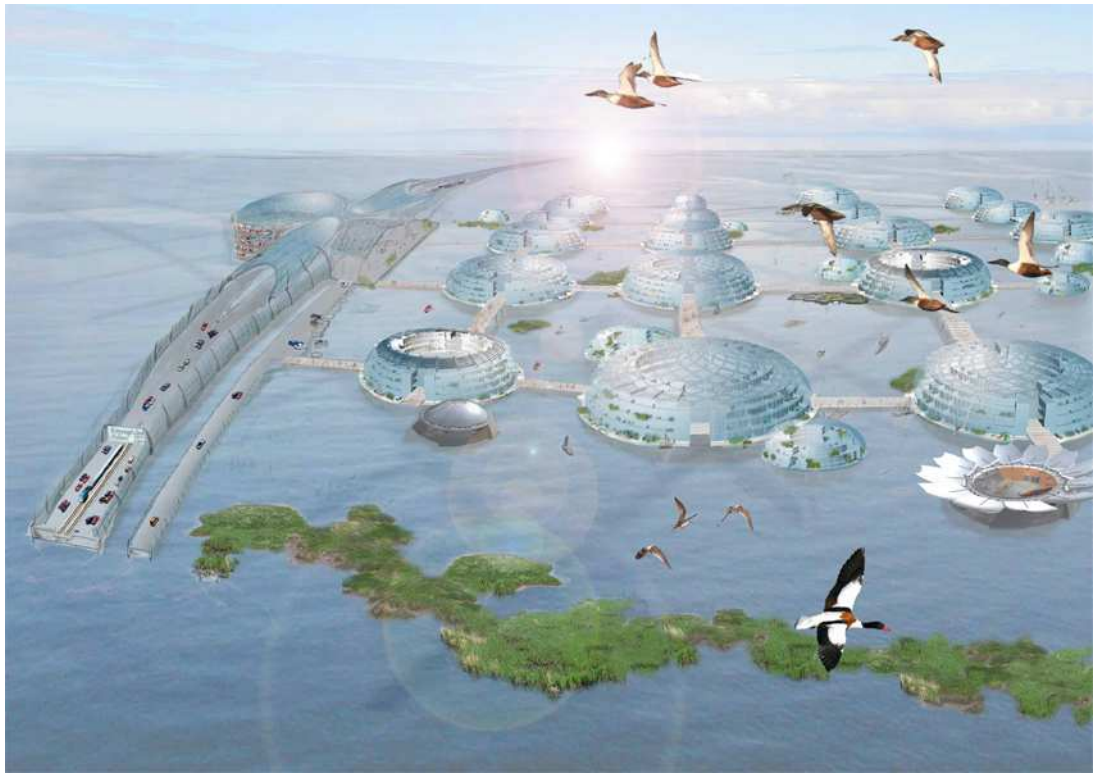
New Projects : AMSTERDAM



1100 hectare urban devopment locations on the IJssel lake

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New Projects : ROTTERDAM

City Ports Area Rotterdam
= 1600 ha van Rotterdam in transformation
= cooperation Port of Rotterdam and municipality of Rotterdam

Floating Pavilion Shanghai WE2010

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Conclusion Part 1

- Urban water innovations are possible and are widely applied
- Urban water system can contribute to making delta areas less vulnerable and more sustainable
  - Use of urban water system as energy source
  - Use of local water resources
  - Floating urbanization

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PART 2: Mainstreaming of urban water innovations: How to get it applied?

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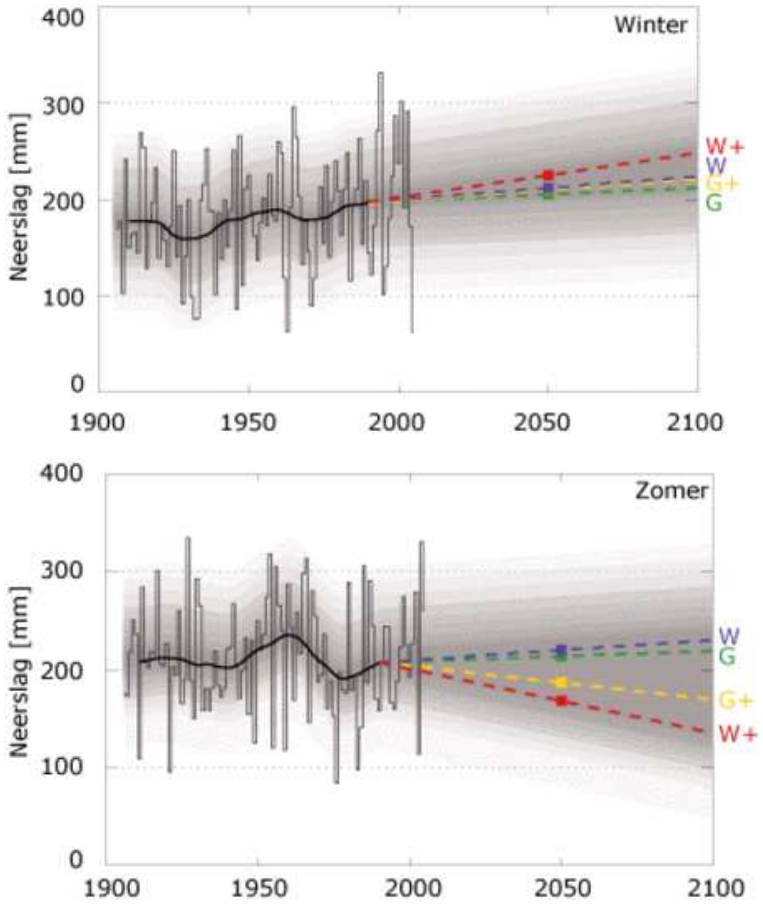
Introduction: Climate change

Source: KNMI, 2006

Rainfall predictions

- Uncertainty
- Variation increases
- Water storage capacity is important for all scenario's



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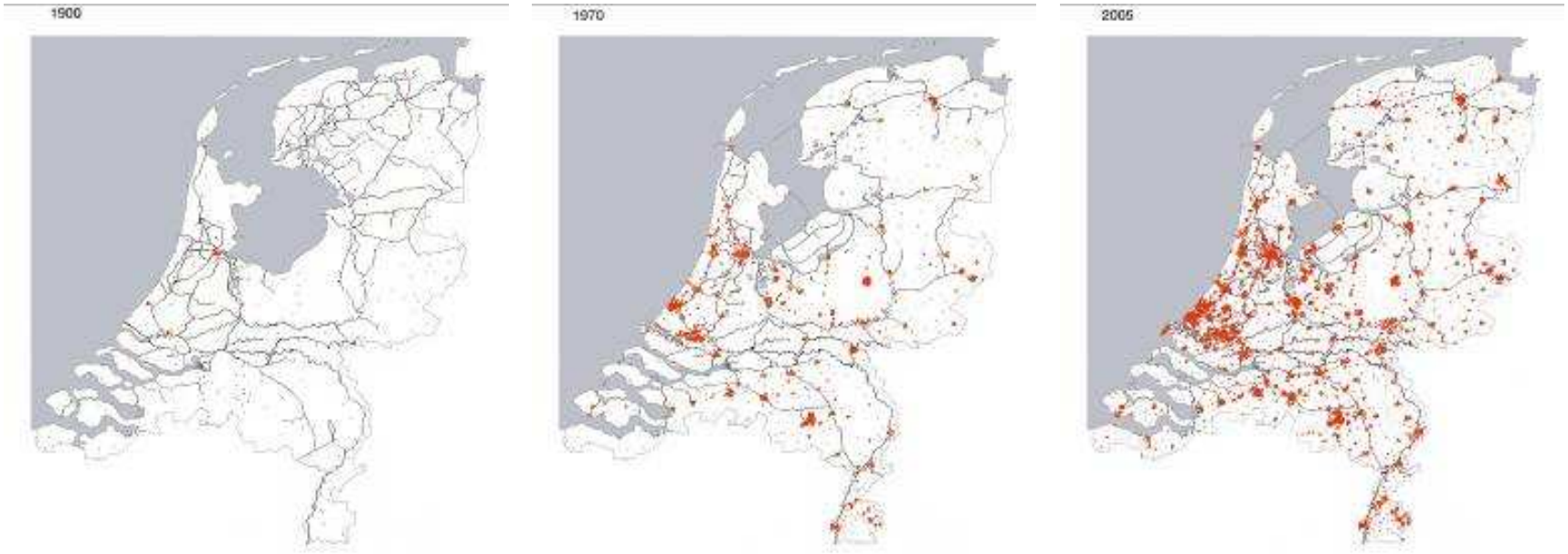
Introduction: Urbanization

1900 1970 2005



Projected additional houses until 2030: 1 to 1.5 mln (VROM, 2005)

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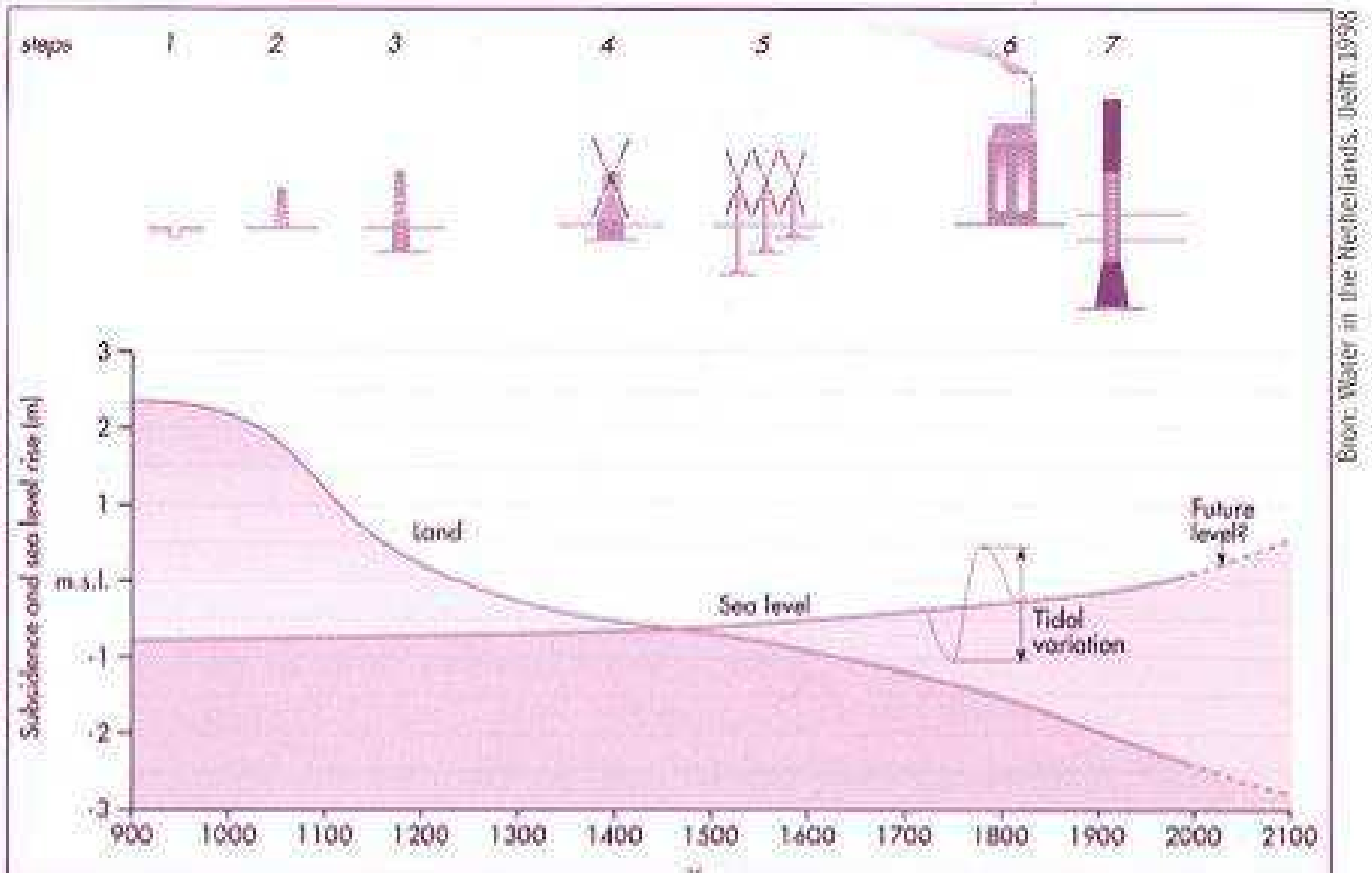
Introduction: Relative terrain level



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Why change?

- Trends combined with traditional urbanization and traditional water management will lead to a delta that is:
  - Increasingly urbanized
  - Increasingly under sea level
  - Increasingly dependent on large scale, globalizing networks of energy, water and food supply
  - Increasingly **vulnerable** to floods and droughts

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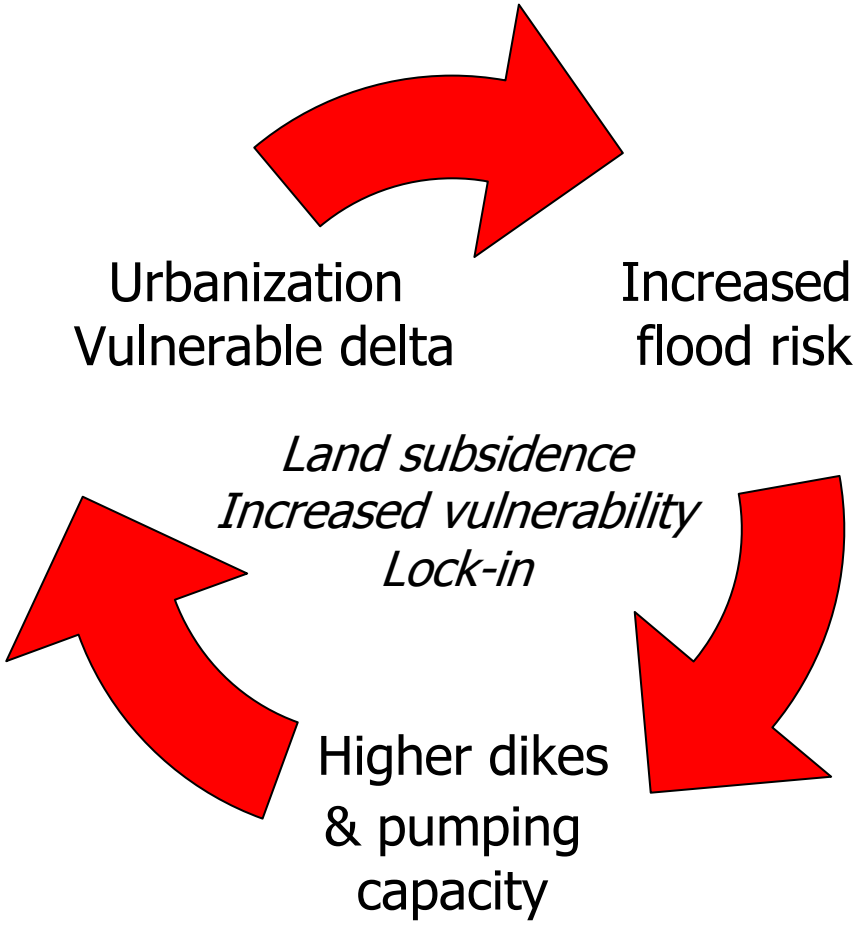
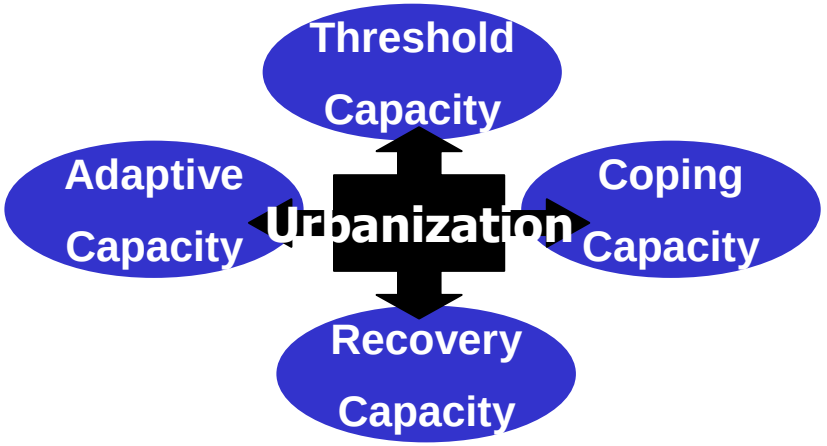
Dutch water vulnerability transition





Source: De Graaf, et al. (2007), Water Science and Technology, Vol 56 No 4, pp 165-173; Natural Hazards (Forthcoming)

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What is a transition?

- Major change in a complex societal system
  - Water management, energy, transportation
- Changes in:
  - Values and norms
  - Technology
  - Legislation
  - Stakeholders and dominant practices
- During a transition a paradigm shift occurs (eg)
  - From centralized water management to WSUD
  - From fossil fuels to renewables
  - From automobility to hydrogen bases smart vehicles
- System innovation rather than system optimization

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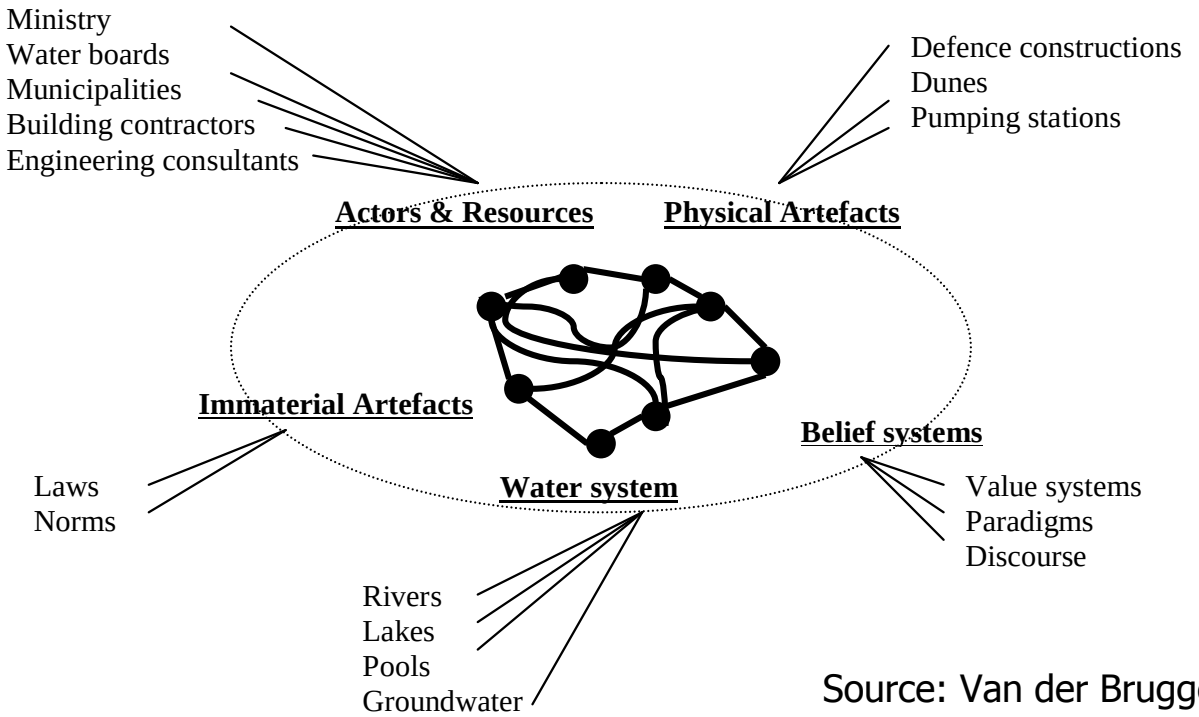
Regime

- Regime: dominant cluster of artifacts, institutions, rules and norms assembled and maintained to perform economic and social activities (Nelson and Winter, 1982; Rip and Kemp, 1998; Geels, 2002, Van de Poel, 2003))



Source: Van der Brugge, 2006

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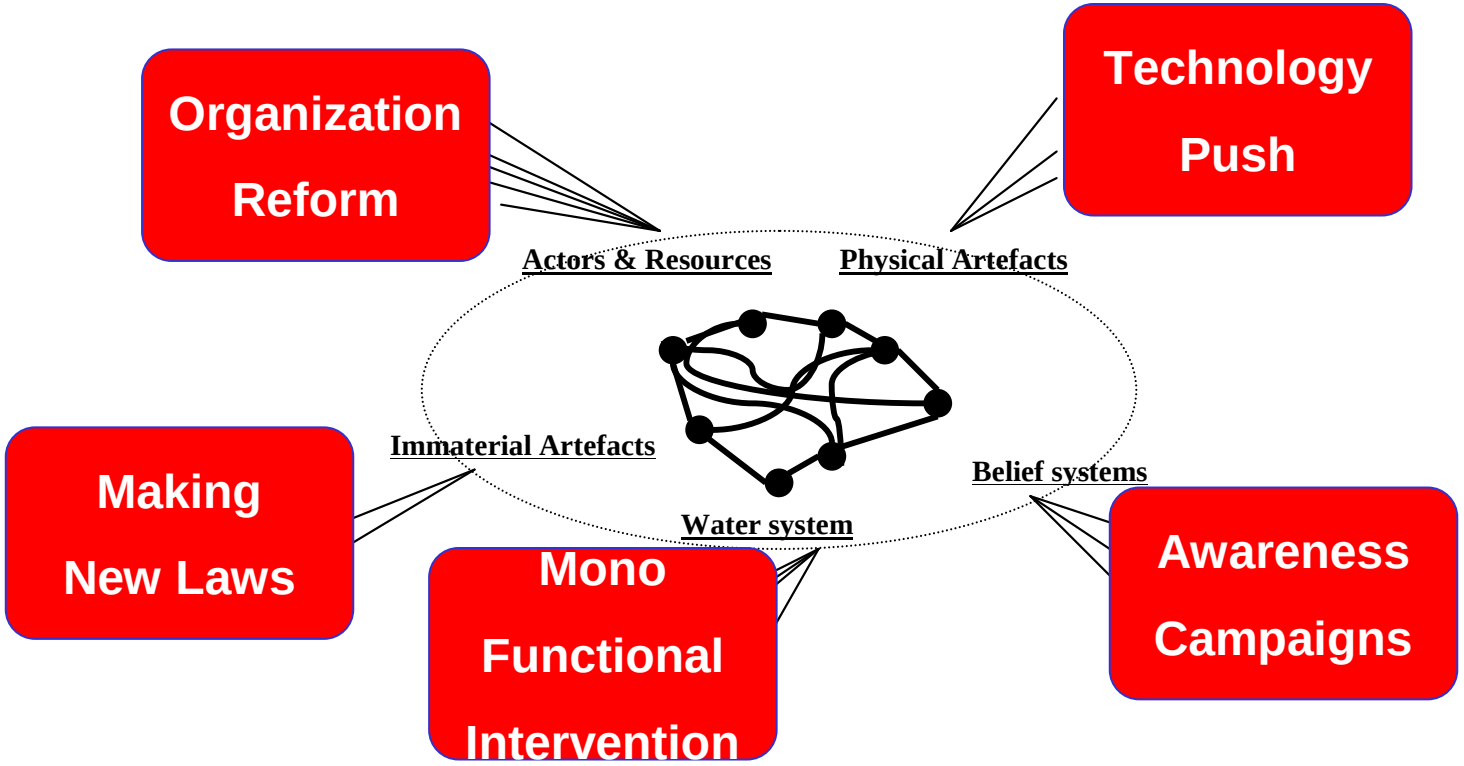
Regime

- Change programs in complex societal systems are mostly focused on one, sometimes two of the regime's components



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Regime

- Change programs in complex societal systems often give disappointing results
  - Regime components are strongly interrelated, changing one component has no effect, limited effects, or unpredicted effects
  - Society consists of a patchwork of multiple complex systems which creates stability, eg. water management is related to housing, transportation, energy, ecology etc.
- Alternative: Change everything at the same time?

Transition management

- Start small scale new regime (niche)
- Transition Management (Loorbach, 2007):
  - Developing a common problem perception and vision
  - Long term collective goal setting
  - Agenda building
  - Experimenting and innovation
  - Evaluation and monitoring
  - Knowledge diffusion and replication
- Make use of calamities and 'Windows of Opportunity'

Transition management

- Regards society as a complex adaptive system
- Long term governance process (decades)
- Focused on fundamental change towards sustainability
- Aims to influence the regular policy development process, niche regime interaction

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Transition management

	Conventional Change Policy	Niche Management	Niche/regime interaction
Actors & Resources	Organization reform	Frontrunners, Change agents	Charismatic 'Sales agents'
Physical Artefacts	Technology Push	Technical Experiments	Improvement & Replication
Belief systems	Awareness campaigns	Demonstration projects	Capacity Building
Immaterial Artefacts	New Laws	Create space in legislation	New institutional mechanisms
Water system	Mono functional intervention in water system	Link water objectives to societal objectives	Incorporate water in total urban environment

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Integrating water management and spatial planning in Rotterdam

Rutger de Graaf
TU Delft, Faculty Civil Engineering and Geosciences, Section of Water Resources
Rutger van der Brugge
Erasmus University Rotterdam, Faculty of Social Sciences, Dutch Research Institute For Transitions

Water Sensitive Urban Design Workshop, Edinburgh, 31 august 2008

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Rotterdam: Facts and Figures

1) the largest port of Europe

2) the second city of the Netherlands

3) three waterboards

- 30 km port
- 600.000 residents
- 2500 km sewer system
- 400 km canals, 600 pumping stations

Source: Municipality of Rotterdam, 2006

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Rotterdam: Impression






Source: Municipality of Rotterdam, 2006

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Research questions

1. Which major changes have occurred in Rotterdam urban water management over the last 20 years?
2. How did Rotterdam develop an urban water management climate adaptation strategy, in which urban development became sensitive to water management?
3. What was the role of the envisioning process *Rotterdam Water City 2035* in this process?

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Methodology

- 16 oral interviews with key-individuals, affiliated with water boards, social housing corporations, consultancy firms and several departments of the municipality
- Analysis of local water policy documents, urban planning documents, internet resources and project plans
- Participation in two field trips and an interdisciplinary urban water design workshop of municipality

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Changes in Rotterdam Water Management

- 3rd national memorandum on water management (1989) responsibility for urban surface water management should be transferred from the municipality to the water boards
- In Rotterdam: First attempt in 1996 failed, Successful transfer in 2001
- Transfer process caused the production of the First Urban Waterplan in 1999 by municipality i.c.w. waterboards
  - Inventory of urban water system
  - Initiation of local projecs e.g. Zuiderpark, Bergse plassen and Urban Canals

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National developments

- Pluvial flooding in Zuid Holland (1998) → Questions in parliament
- Committee Tielrooij: Report Water management 21st Century, more space for water (2000). Retention strategy rather than drainage strategy
- Water Assessment (2003), water authorities' involvement in urban development becomes obligatory
- National Agreement on Water Management (2004) → allowable pluvial flooding return interval urban areas=100Y
  - First Estimate required additional water retention capacity in Rotterdam: 600,000 m^3 in 2015

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Changes in stakeholder perceptions

Causes:

1. Transfer of responsibility urban water management
2. Waterboards and municipality make inventory in First Waterplan

Water boards discover that there are conflicting spatial interests in city; water has low priority

Water managers realize they need to cooperate with other stakeholders to achieve their objectives

Water managers learn that scarcity of space in cities requires multi-functional land-use

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Changes in stakeholder perceptions

Water managers anticipate on city planning and the importance of utilizing 'windows of opportunity' in urban renewal processes

Water managers and urban designers discover that surface water can contribute to solving urban problems.

Result:
- Water boards and municipality co-develop plans for water infrastructure innovations in cooperation with other stakeholders
- Strongly connected with city planning

What was the role of the envisioning process Rotterdam Water City 2035 in this process?

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Rotterdam Watercity 2035

- Long term envisioning process
- Rotterdam's submission for the 2nd International Architecture Biennale Rotterdam
- 2005 theme was ' The Flood'
- Develop joint vision on the combined water challenge and urban challenge
- How can the water threat become an opportunity?

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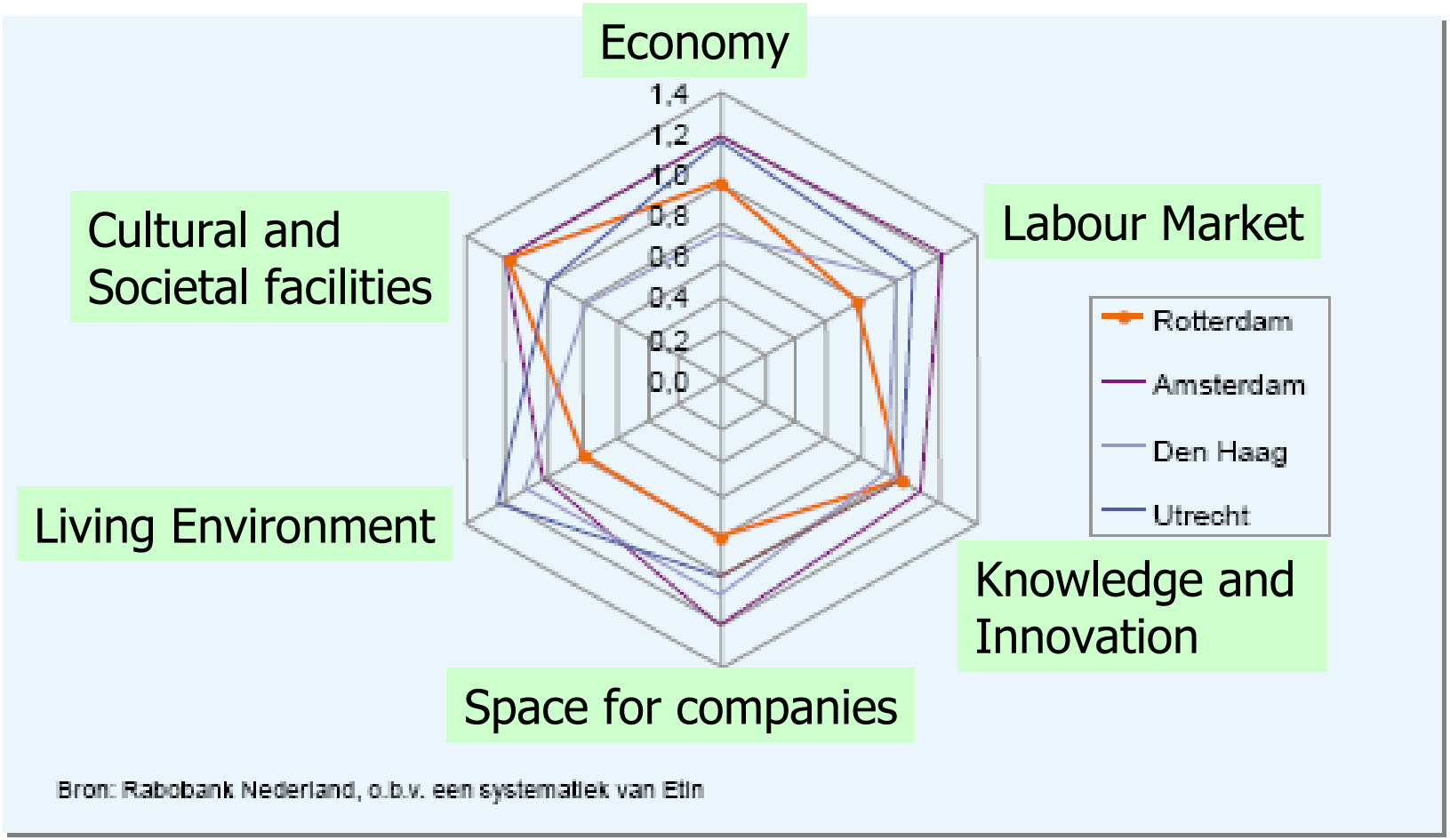
Urban Challenge



Bron: Rabobank Nederland, o.b.v. een systematiek van Etin

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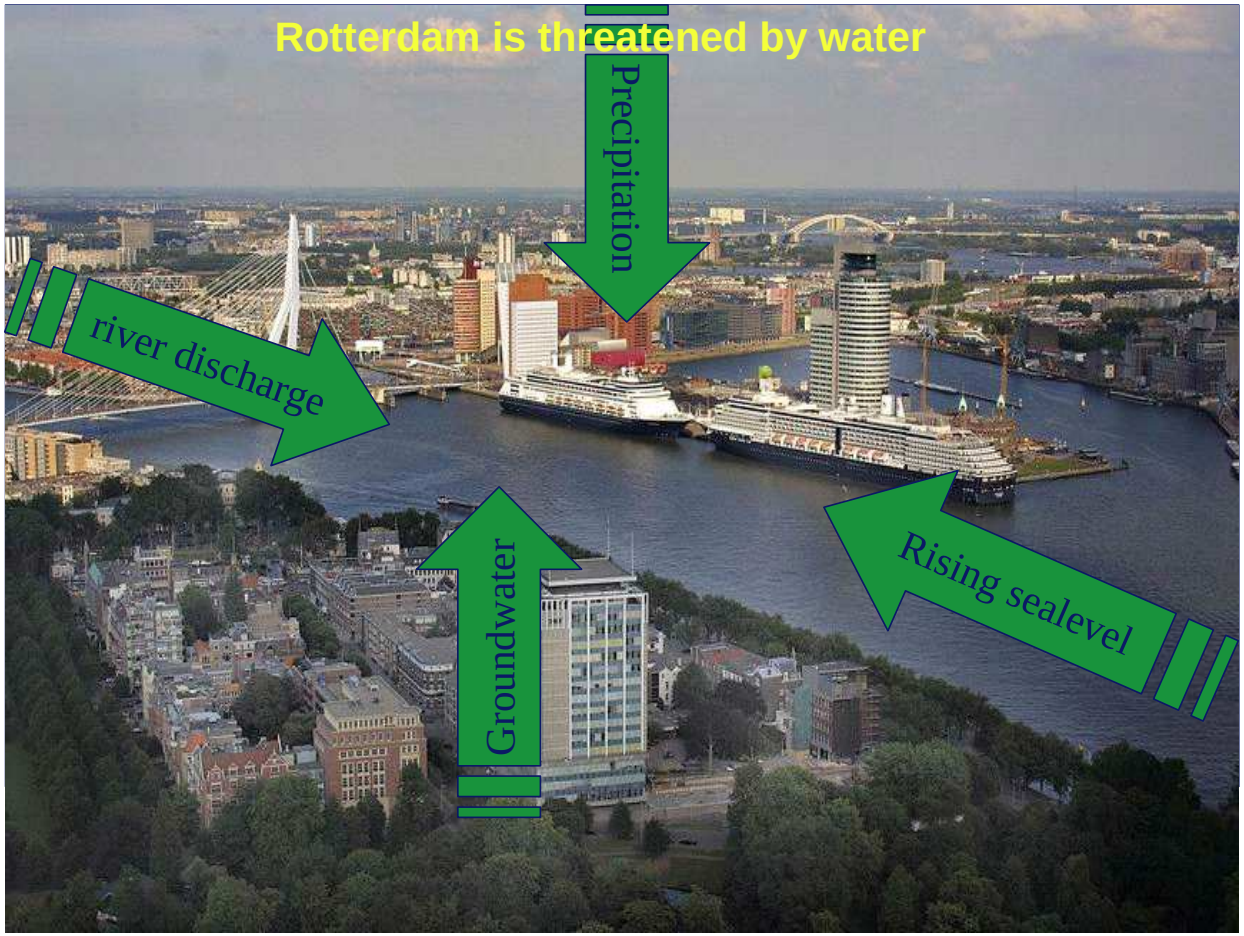
Water Challenge



Source: Municipality of Rotterdam, 2006

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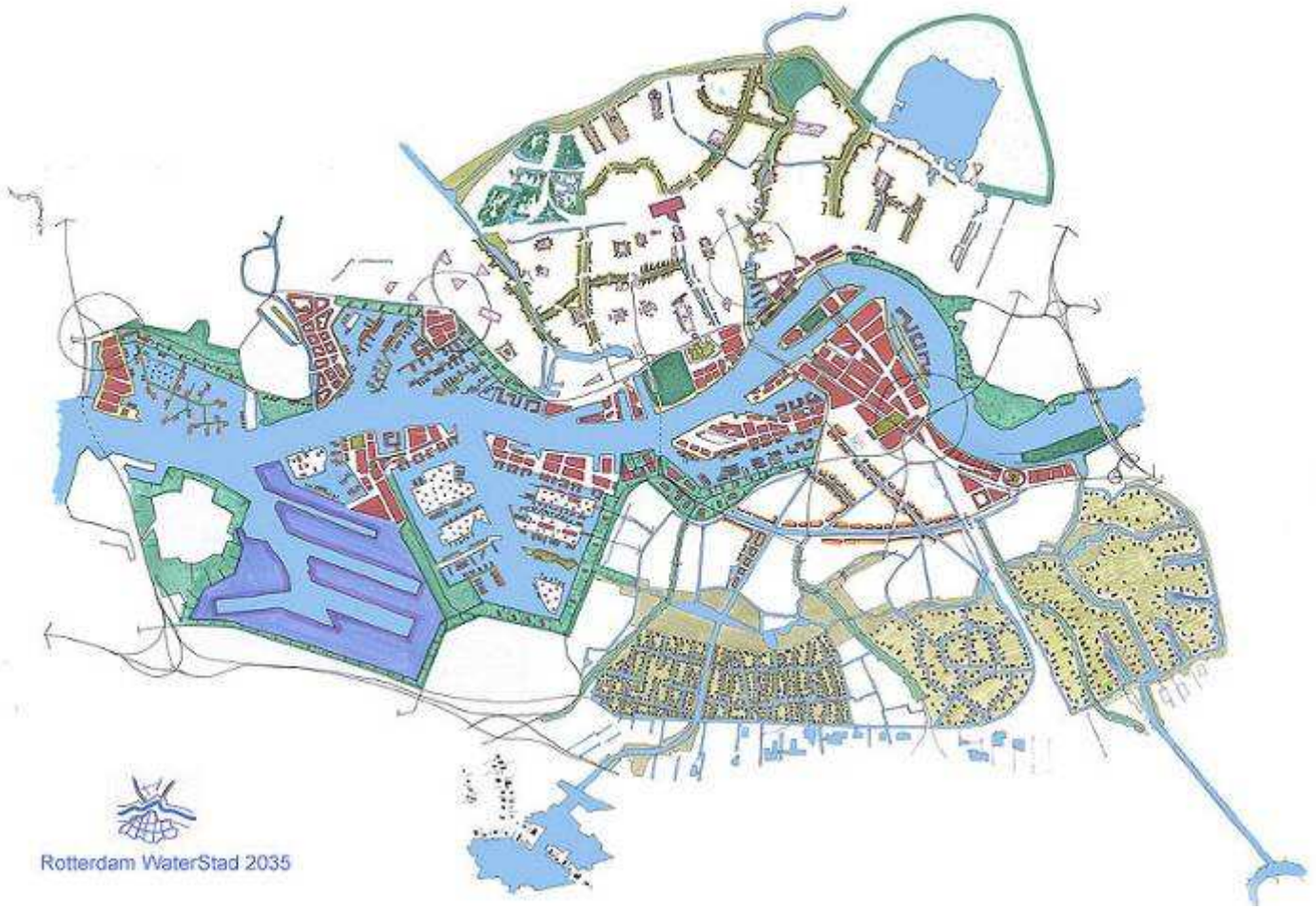
Rotterdam Watercity 2035



Source: Municipality of Rotterdam, 2006

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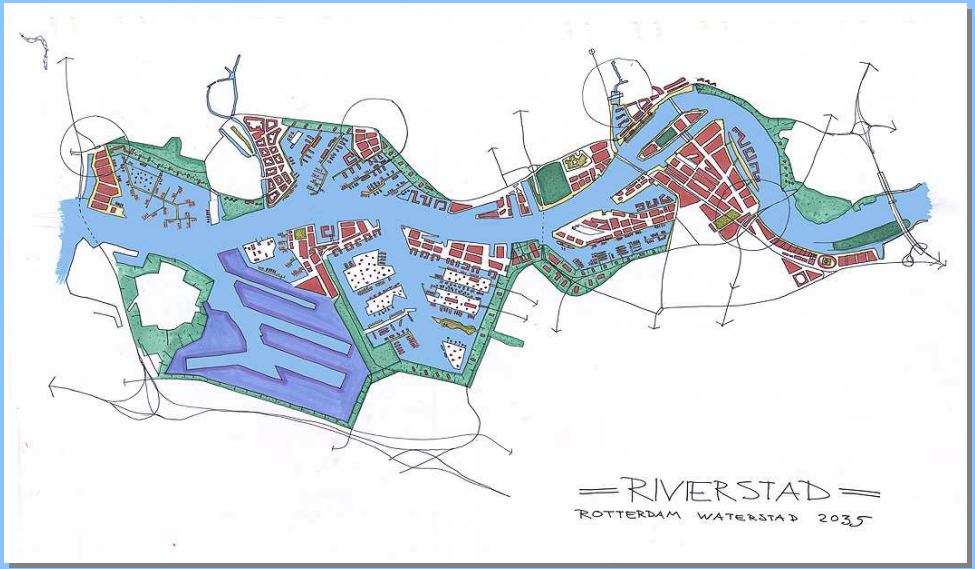
Rotterdam Watercity 2035

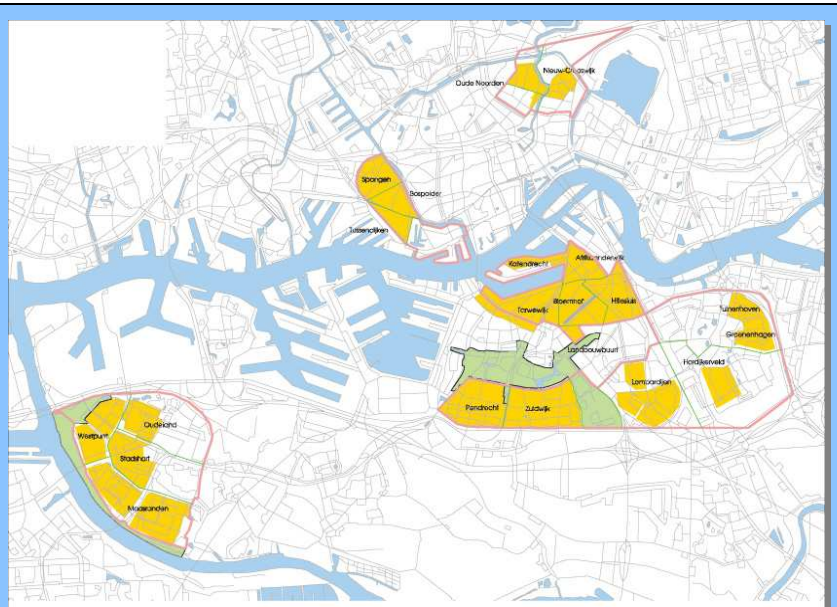


Source: Municipality of Rotterdam, 2006

Rotterdam Watercity 2035

Source: Municipality of Rotterdam, 2006

Rotterdam Watercity 2035



Rotterdam Watercity 2035

Source: Municipality of Rotterdam, 2006

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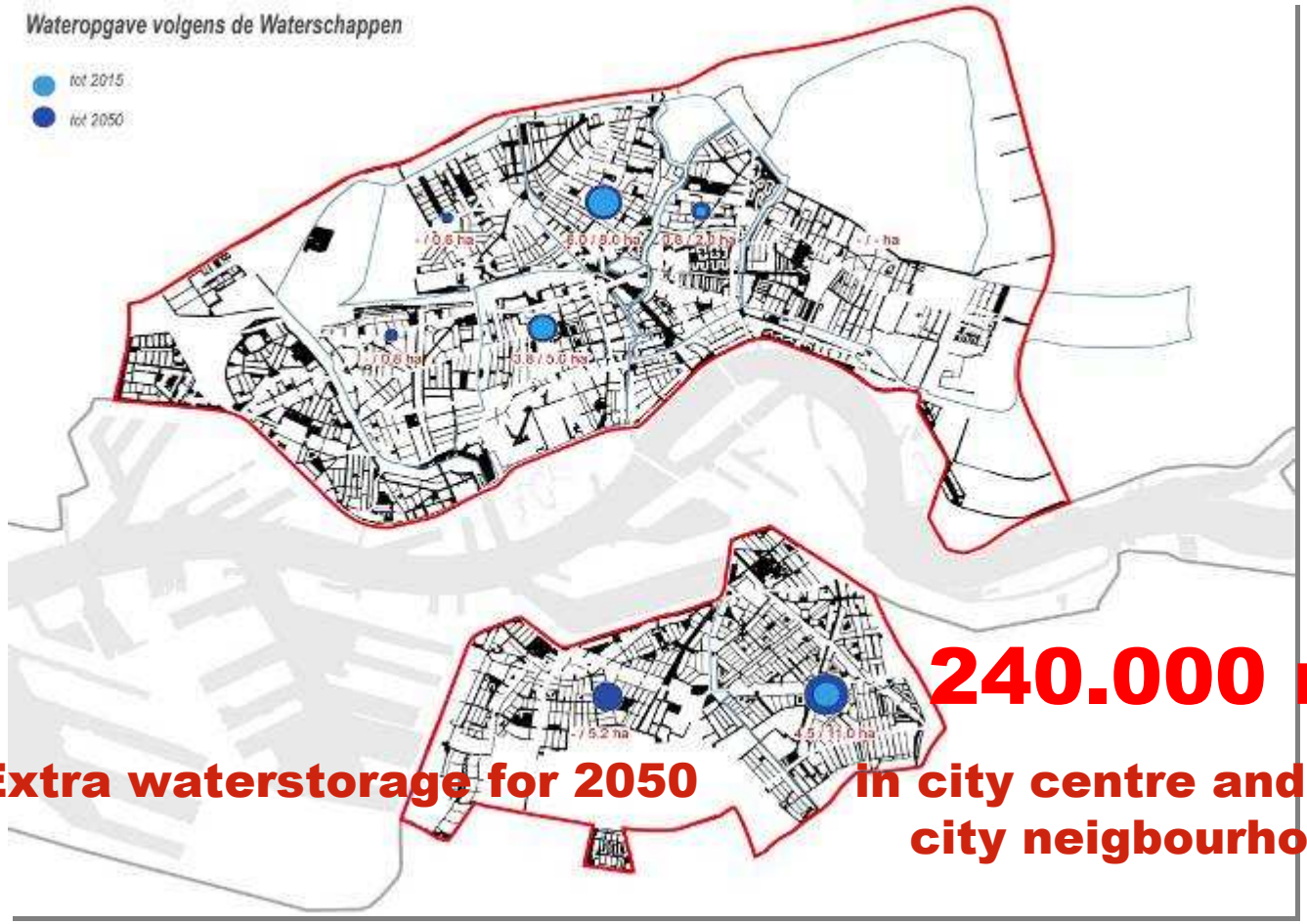
Rotterdam Watercity 2035



240.000 m3

Extra waterstorage for 2050 in city centre and "old city neigbourhoods"

Source: Municipality of Rotterdam, 2006

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Role of WaterCity 2035

- Shared vision that generated attention of public and politicians, prize winner → water higher on the agenda
- Alignment objectives and mutual understanding between municipality departments and between waterboards and municipality
- Created a network for further cooperation

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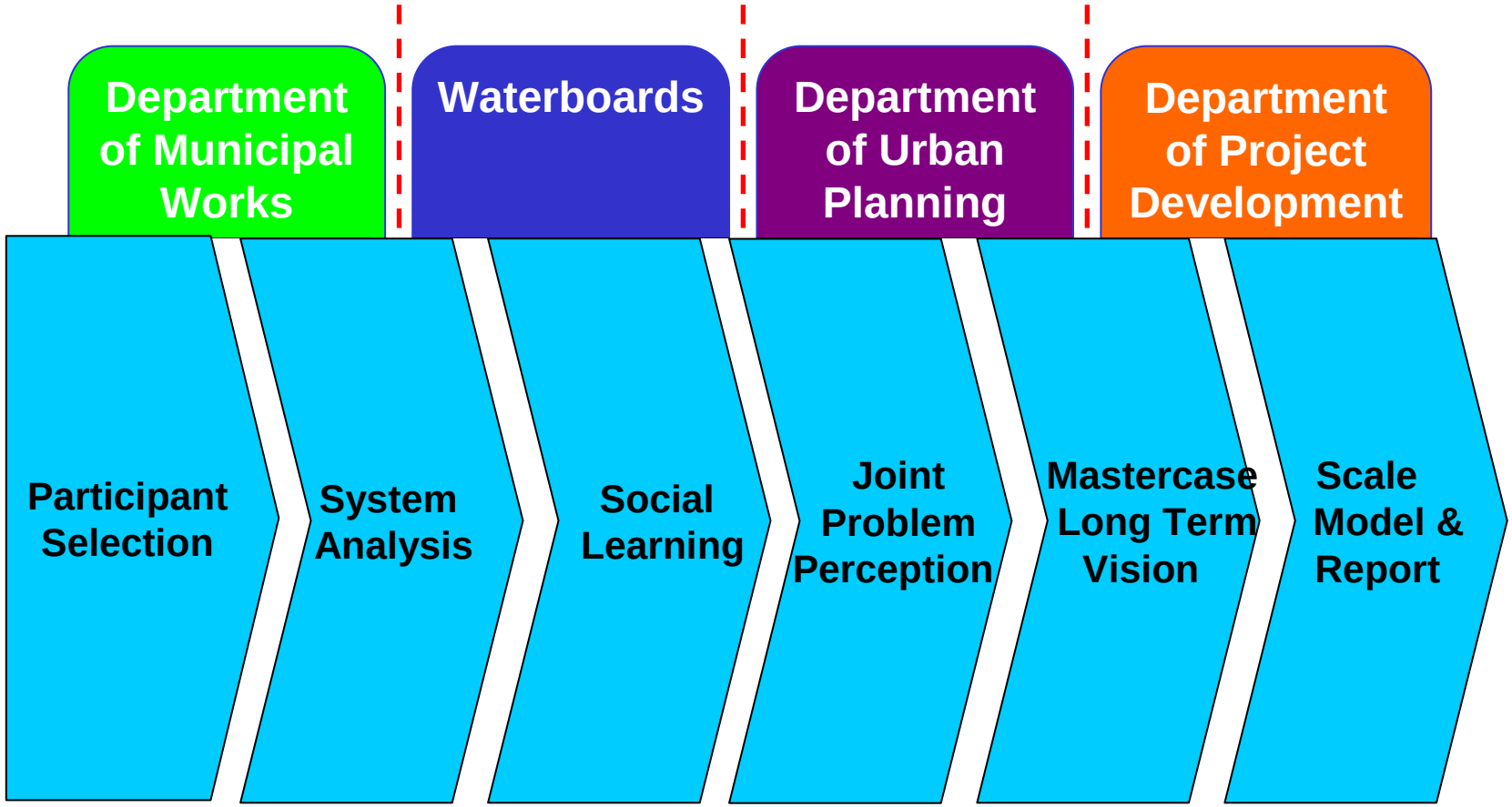
Role of WaterCity 2035



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Success factors of WaterCity 2035

- Successful connection between water management and spatial planning
- 2 moderators: a water expert and an urban designer
- Time pressure and high status of the project have been crucial
  - Selection of only best 16 participants
  - Competition
  - Absence not allowed by directors of department

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Success factors of WaterCity 2035

- 3 studies (joint system analysis as starting point):
  - Water, History and Culture
  - Water and facts
  - Experience & Enjoy
- 'Non official' policy process with a huge impact on regular policy process
  - Possibility to generate extreme ideas
  - Possibility to cross boundaries
  - Low risk, if it fails it is just a competition

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Mainstreaming of WaterCity 2035

- Many ideas have been adopted by official policy Waterplan 2
- The network of cooperation that emerged during the process is still operating
- A change of thinking among stakeholders has taken place, e.g.:

  'In the old approach we said: 'provide us with the square meters and we will dig water in a cost-effective way. In the new approach we say: 'we are open to water infrastructure innovations, such as water retention squares and green roofs'

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Concluding remarks

- Major changes have occurred in Rotterdam water management in terms of thinking, institutional arrangements and planning process
- Integration of spatial planning and urban water planning. What about implementation and maintenance? What about private sector?
- The role of the future envisioning process WaterCity 2035 has been crucial

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For discussion

- How to involve private sector?
- What kind of institutional arrangements are possible for multi-stakeholder implementation and maintenance in addition to planning?
- Is public participation necessary in this process?

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Receptivity for change among professionals and policymakers

Receptivity continuum (Jeffrey and Seaton, 2003):

- *Awareness*: being aware that a problem exists, and that alternative options are available.
- *Association*: associate these alternative options with your own agenda and objectives
- *Acquisition*: being able (having the capacity) to acquire, implement, operate and maintain the alternative technical options
- *Application:* Having sufficient incentives (for instance: legal, financial) to actually apply the alternative technical options

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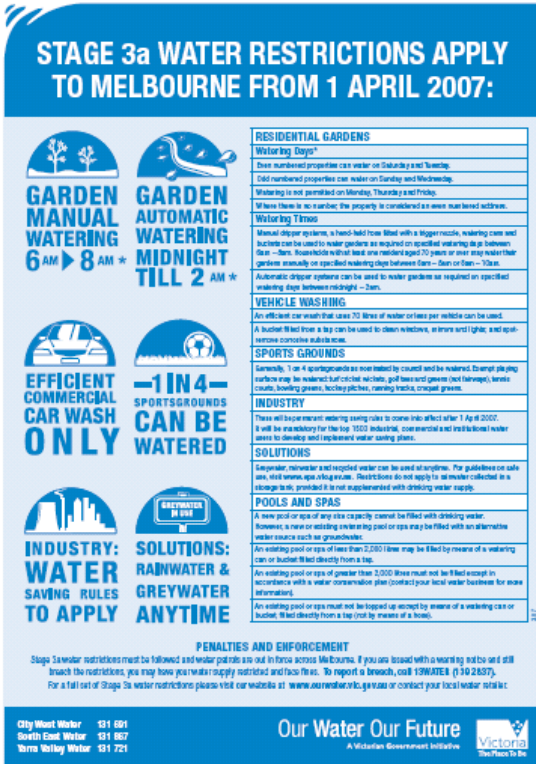
Awareness



STAGE 3a WATER RESTRICTIONS APPLY TO MELBOURNE FROM 1 APRIL 2007:

GARDEN MANUAL WATERING 6 AM ▶ 8 AM *

GARDEN AUTOMATIC WATERING MIDNIGHT TILL 2 AM *

EFFICIENT COMMERCIAL CAR WASH ONLY

–1 IN 4– SPORTSGROUNDS CAN BE WATERED

INDUSTRY: WATER SAVING RULES TO APPLY

SOLUTIONS: RAINWATER & GREYWATER ANYTIME

RESIDENTIAL GARDENS
Watering Days*
Even numbered properties can water on Saturday and Tuesday.
Odd numbered properties can water on Sunday and Wednesday.
Watering is not permitted on Monday, Thursday and Friday.
Where there is no number, the property is considered an even numbered address.
Watering Times
Manual dripper systems, a hand-held hose fitted with a trigger nozzle, watering cans and buckets can be used to water gardens as required on specified watering days between 6am – 8am. Households without at least one resident aged 70 years or over may water their gardens manually on specified watering days between 6am – 8am or 8am – 10am.
Automatic dripper systems can be used to water gardens as required on specified watering days between midnight – 2am.
VEHICLE WASHING
An efficient car wash that uses 70 litres of water or less per vehicle can be used.
A bucket filled from a tap can be used to clean windows, mirrors and lights, and spot-remove corrosive substances.
SPORTS GROUNDS
Generally, 1 on 4 sportsgrounds as nominated by council and be watered. Exempt playing surface may be watered: turf cricket wickets, golf tees and greens (not fairways), tennis courts, bowling greens, hockey pitches, running tracks, croquet greens.
INDUSTRY
These will be permanent watering saving rules to come into effect after 1 April 2007. It will be mandatory for the top 1500 industrial, commercial and institutional water users to develop and implement water saving plans.
SOLUTIONS
Sprinkler, rainwater and recycled water can be used at anytime. For guidelines on safe use, visit www.epa.vic.gov.au. Restrictions do not apply to rainwater collected in a storage tank, provided it is not supplemented with drinking water supply.
POOLS AND SPAS
A new pool or spa of any size capacity cannot be filled with drinking water. However, a new or existing swimming pool or spa may be filled with an alternative water source such as ground water.
An existing pool or spa of less than 2,000 litres may be filled by means of a watering can or bucket filled directly from a tap.
An existing pool or spa of greater than 2,000 litres must not be filled except in accordance with a water conservation plan (contact your local water business for more information).
An existing pool or spa must not be topped up except by means of a watering can or bucket, filled directly from a tap (not by means of a hose).

PENALTIES AND ENFORCEMENT

Stage 3a water restrictions must be followed and water patrols are out in force across Melbourne. If you are issued with a warning notice and still breach the restrictions, you may have your water supply restricted and face fines. To report a breach, call 13WATER (130 2837).

For a full set of Stage 3a water restrictions please visit our website at www.ourwater.vic.gov.au or contact your local water retailer.

City West Water 131 691
South East Water 131 853
Yarra Valley Water 131 721

Our Water Our Future
A Victorian Government Initiative

Victoria The Place To Be

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Association

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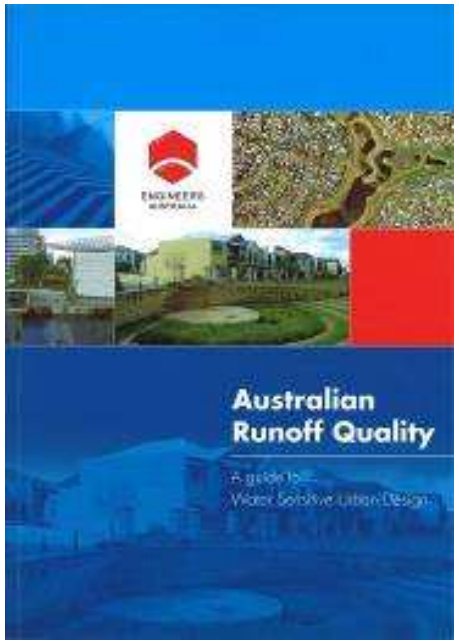
Acquisition



GreenPlumbers®
CARING FOR OUR WATER

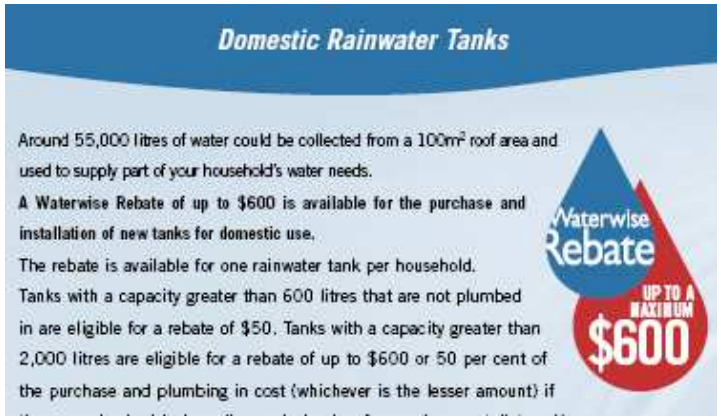
clearwater
SUPPORTING SUSTAINABLE URBAN WATER MANAGEMENT

New WAter Ways

TU Delft

Application

- Binding regulations
- Subsidy schemes



Domestic Rainwater Tanks

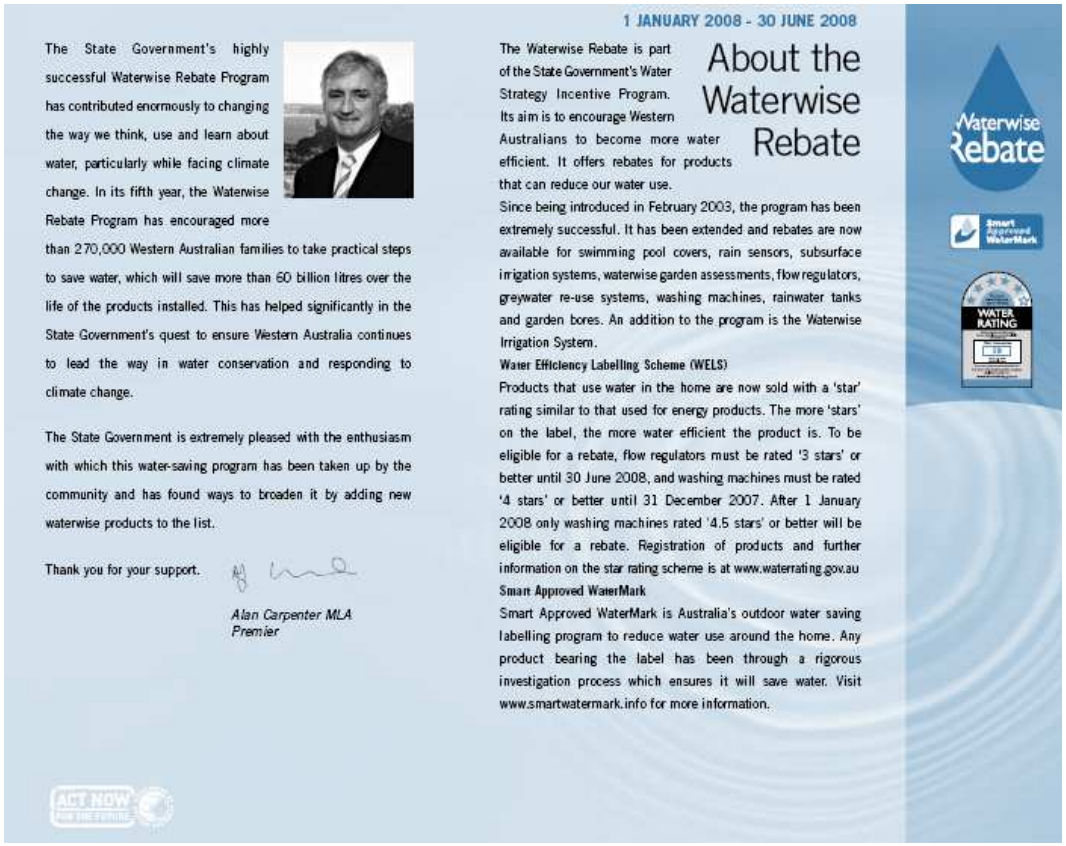
Around 55,000 litres of water could be collected from a 100m² roof area and used to supply part of your household's water needs.

A Waterwise Rebate of up to $600 is available for the purchase and installation of new tanks for domestic use.

The rebate is available for one rainwater tank per household.

Tanks with a capacity greater than 600 litres that are not plumbed in are eligible for a rebate of $50. Tanks with a capacity greater than 2,000 litres are eligible for a rebate of up to $600 or 50 per cent of the purchase and plumbing in cost (whichever is the lesser amount) if

Waterwise Rebate UP TO A MAXIMUM $600



The State Government's highly successful Waterwise Rebate Program has contributed enormously to changing the way we think, use and learn about water, particularly while facing climate change. In its fifth year, the Waterwise Rebate Program has encouraged more than 270,000 Western Australian families to take practical steps to save water, which will save more than 60 billion litres over the life of the products installed. This has helped significantly in the State Government's quest to ensure Western Australia continues to lead the way in water conservation and responding to climate change.

The State Government is extremely pleased with the enthusiasm with which this water-saving program has been taken up by the community and has found ways to broaden it by adding new waterwise products to the list.

Thank you for your support.

Alan Carpenter MLA
Premier

1 JANUARY 2008 - 30 JUNE 2008

About the Waterwise Rebate

The Waterwise Rebate is part of the State Government's Water Strategy Incentive Program. Its aim is to encourage Western Australians to become more water efficient. It offers rebates for products that can reduce our water use.

Since being introduced in February 2003, the program has been extremely successful. It has been extended and rebates are now available for swimming pool covers, rain sensors, subsurface irrigation systems, waterwise garden assessments, flow regulators, greywater re-use systems, washing machines, rainwater tanks and garden bores. An addition to the program is the Waterwise Irrigation System.

Water Efficiency Labelling Scheme (WELS)

Products that use water in the home are now sold with a 'star' rating similar to that used for energy products. The more 'stars' on the label, the more water efficient the product is. To be eligible for a rebate, flow regulators must be rated '3 stars' or better until 30 June 2008, and washing machines must be rated '4 stars' or better until 31 December 2007. After 1 January 2008 only washing machines rated '4.5 stars' or better will be eligible for a rebate. Registration of products and further information on the star rating scheme is at www.waterrating.gov.au

Smart Approved WaterMark

Smart Approved WaterMark is Australia's outdoor water saving labelling program to reduce water use around the home. Any product bearing the label has been through a rigorous investigation process which ensures it will save water. Visit www.smartwatermark.info for more information.

Waterwise Rebate

WATER RATING

ACT NOW

http://portal.water.wa.gov.au/portal/page/portal/WiseWaterUse/

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Conclusions Part 2

- Integration of water management and urban planning is important element
  - Cooperation water managers and planners
  - Non official policy processes
- Receptivity of stakeholders determines if innovations are applied.
  - 4A's

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Questions

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