

Water Sensitive Urban Design (WSUD) Masterclass

Cities, Communities, Water and Public Space Design

Raul Marino

(Research Fellow, Monash University)



Water Sensitive Urban Design Masterclass – Agenda

- 1:30 Introduction
- 1:40 WSUD Framework and Experiences in world cities
- 2:25 WSUD Framework: The Australian Experience
- 3:00 Break
- 3:15 Applying WSUD in Indonesia: AIC Case Studies discussion (Pulo Geulis, Cibinong)
- 4:15 Groups Report Back
- 4:45 Panel Discussion
- 5:15 End of Masterclass

Good urban design is key for the enjoyment of public spaces

- Human interaction is very important for a healthy life and community integration.
- The places for these interactions have been replaced for private spaces (normally shopping malls), which affects the way people experience their cities
- Some reasons for not using public spaces as meeting and relax places are: Climate, insecurity, pollution and lack of places that engage and offer a variety of experiences for users.
- Good Urban Design takes into consideration this factors to provide city dwellers with public spaces that offer comfortable, safe and exiting experiences for its users.



Good urban design is key for the enjoyment of public spaces

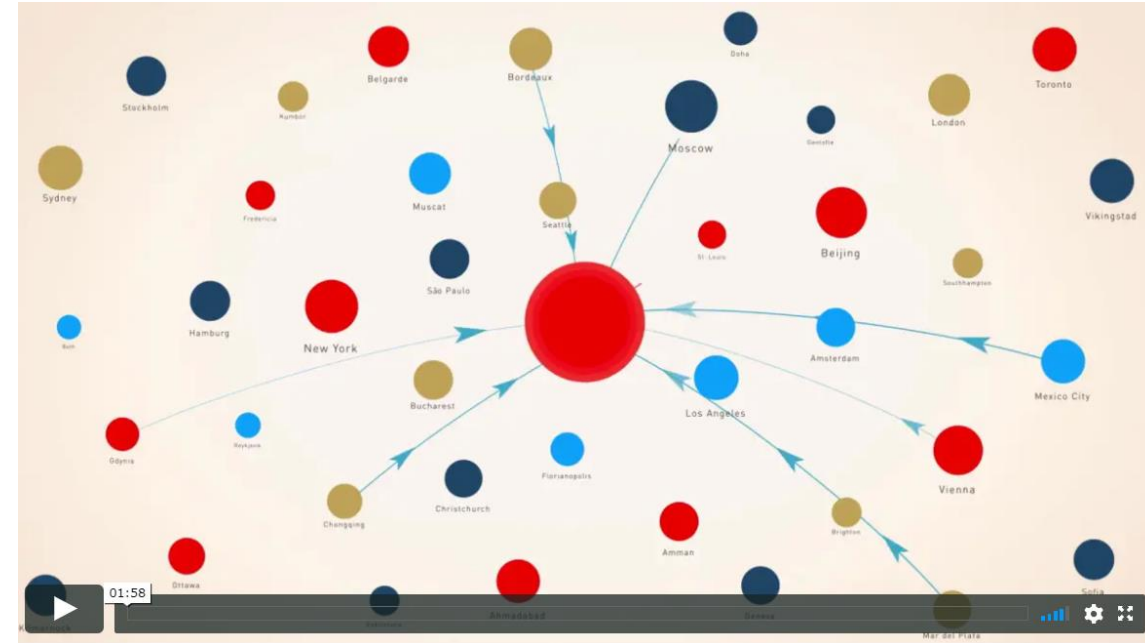
- Quick Questions to the audience:
- *Do you meet/hang around more often in shopping malls or public spaces?*
- *Do you prefer to walk to your destination if it's a short distance travel? If not, why?*
- *What stops you for using public spaces more often?*



Kalijodo Park Jakarta

Urban Design: Making Cities for people

- Cities undergoing rapid urbanization face the challenges of providing infrastructure to cope with the growing population
- Most cities have given priorities to infrastructure such as transport or services over public space networks
- Our approach is based on making cities and public spaces where the pedestrian user experience is the most important element of the the design.



<https://gehlpeople.com/approach/>

Urban Design: Walkable Cities

- Active transport (walking, bicycle) provides large benefits for cities and users, by increasing physical activity and decreasing carbon related transport emissions.
- Walkability is a measure of how friendly an area is to walking. Walkability has health, environmental, and economic benefits.
- Factors influencing walkability include the presence or absence and quality of footpaths, sidewalks or other pedestrian rights-of-way, traffic and road conditions, land use patterns, building accessibility, and safety, among others.
- Walkability is an important concept in sustainable urban design.



What is Water Sensitive Urban Design?

- Water-sensitive urban design (WSUD) is a land planning and engineering design approach which integrates the urban water cycle, including stormwater, groundwater and wastewater management and water supply, into urban design *to minimise environmental degradation and improve aesthetic and recreational appeal*
- WSUD is a term used in the Middle East and Australia and is similar to low-impact development (LID), a term used in the United States; and Sustainable Drainage System (SuDS), a term used in the United Kingdom and Integrated Water Management Development in Germany.



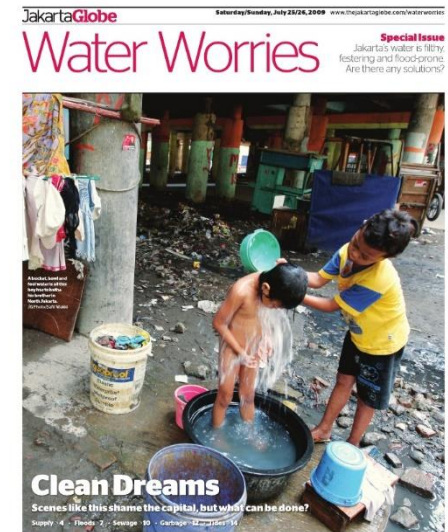
Why Cities need WSUD?

- From population growth to rapid urbanization, changing consumption patterns to deteriorating infrastructure, increasing energy prices to climate change: water systems in cities throughout the world are confronted by an intimidating future. Water Sensitive Urban Design (WSUD) can make a difference. The interactions between the different elements of the urban water cycle;
- the wide-reaching benefits of an integrated approach to managing water;
- the recommended phases of a strategic planning process; and
- ways and means to work with local stakeholders effectively.
- Masterclass Target group: Water managers, urban planners and engineers from local governments and water, wastewater and drainage utilities.



Why Bogor needs WSUD?

- Bogor is the Rain City of Java, but this valuable resource is not harvested
- At the same time, it have problems to provide domestic and commercial water supply
- Also, stormwater runoff affects the recharge of wells and the population living downstream, especially in low areas in Jakarta, with large areas flooded constantly
- Very low water quality due to Water pollution from domestic and commercial wastewater



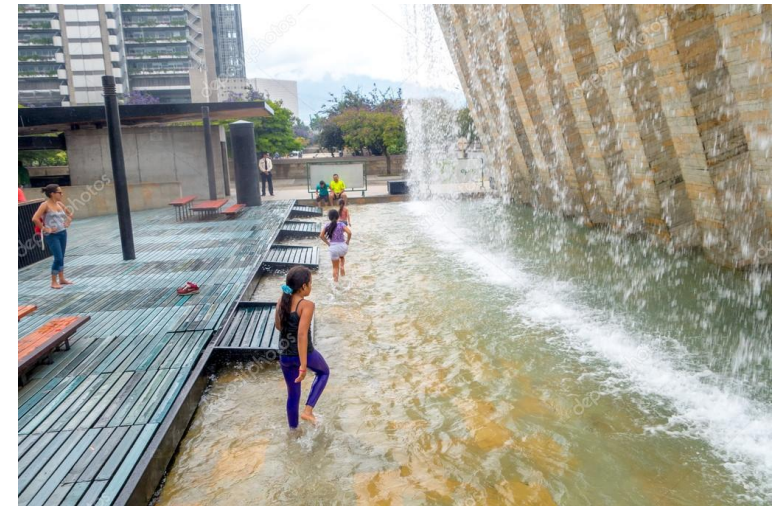
Differences between conventional approach and WSUD

- Conventional Urban Design is not specially concern on the impact of design into the Urban Water Cycle
- WSUD regards urban stormwater runoff *as a resource* rather than a nuisance or liability. This represents a paradigm shift in the way environmental resources and water infrastructure are dealt with in the planning and design of towns and cities.
- WSUD principles regard all streams of water as a resource with diverse impacts on biodiversity, water, land, and the community's recreational and aesthetic enjoyment of waterways.

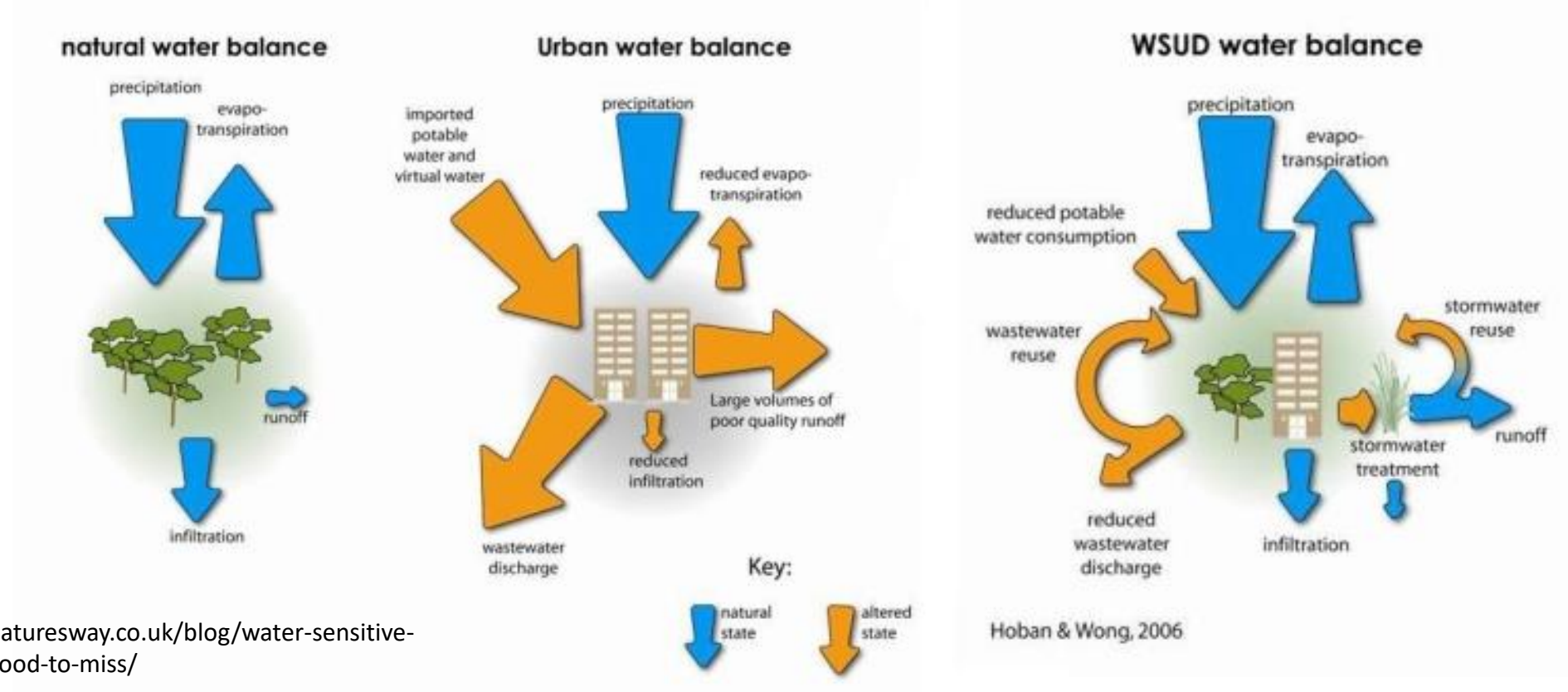


WSUD: People and Water in Urban Spaces

- Water is not only vital for life but is an integral element for the user's experience in public spaces.
- Urban Spaces that provide innovative design with water for playing, enjoying or amenity are the most successful in many cities in the world
- Creek banks, River banks, lakes and pondsides and Sea Sides areas have a great potential to transform communities and celebrate water in urban environments.

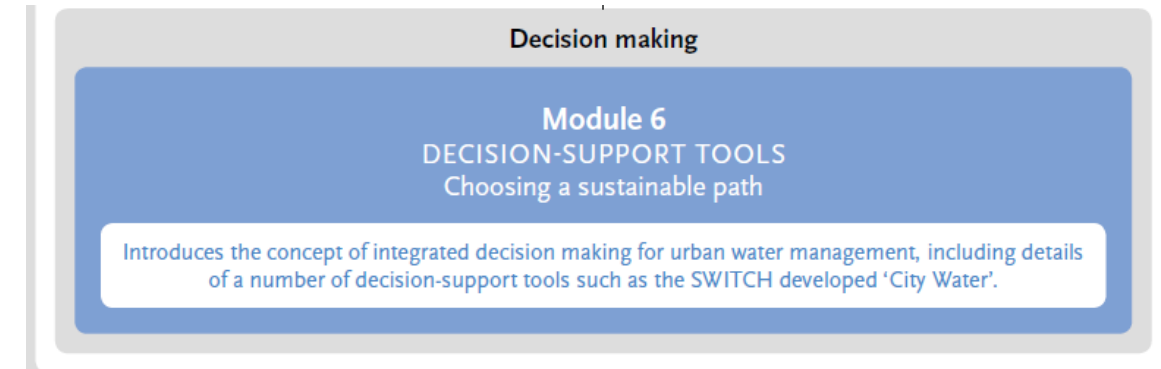
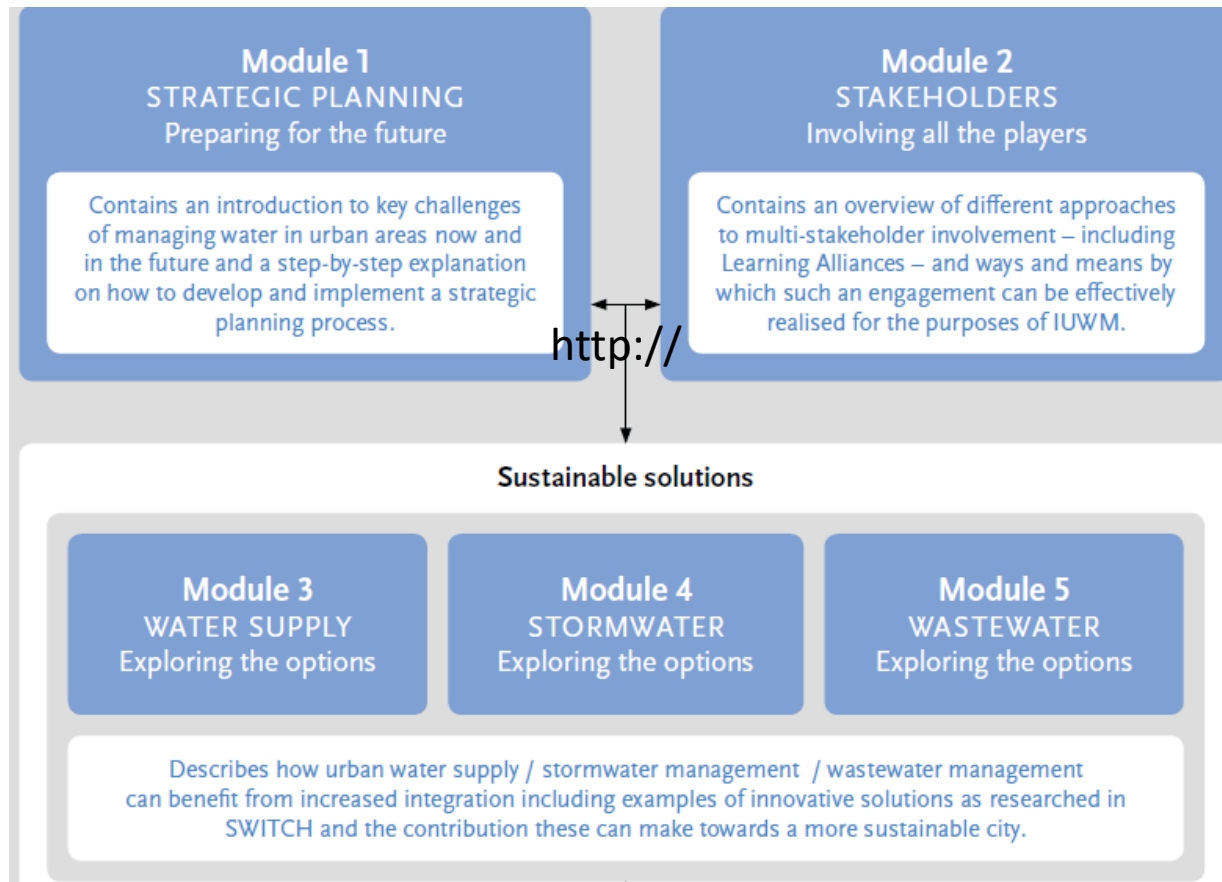


WSUD Framework: Natural and altered Water Balance



<http://www.engineeringnaturesway.co.uk/blog/water-sensitive-urban-design/wsud-too-good-to-miss/>

WSUD Masterclass Structure:



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

Strategic Planning – Preparing for the future

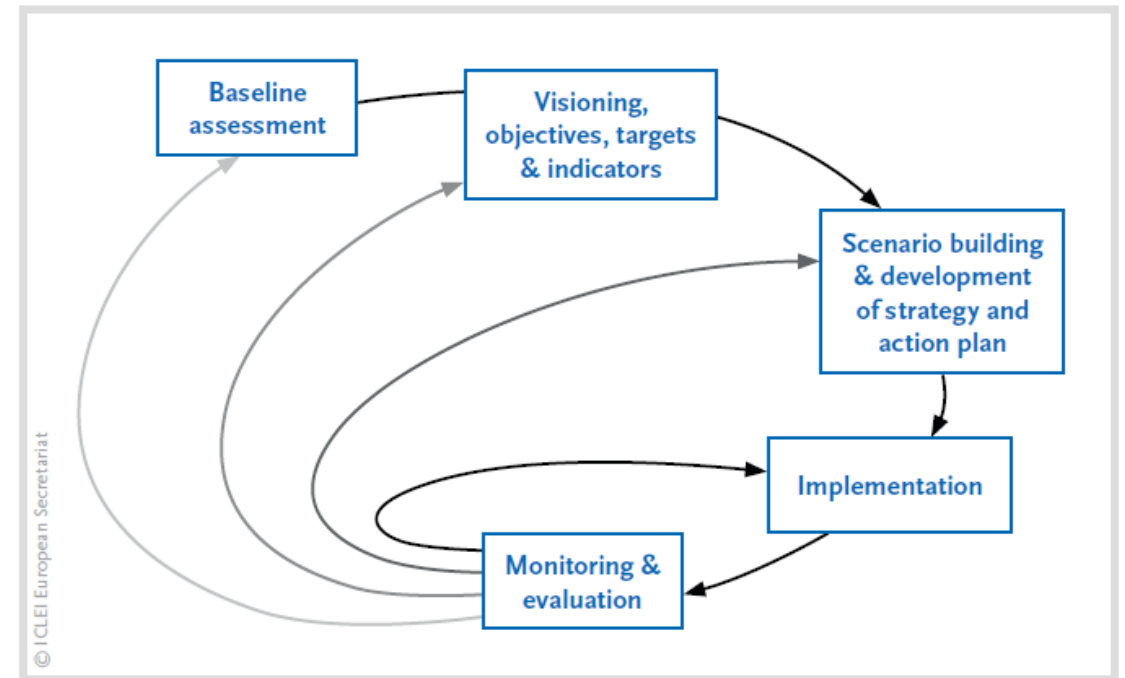
- - In most cities, the different sectors of the urban water cycle – water supply, stormwater, wastewater – are managed by different departments and institutions with minimal coordination in their design and operation.
- - As pressures such as climate change, population growth and ageing infrastructure increase, this fragmented approach and its dependence on conventional technologies is no longer sufficient to deliver the water services that cities rely on.
- - Water Sensitive Urban Design is an alternative approach. WSUD recognises that problems encountered in one area of the urban water cycle may be the result of (mis)management in another.
- - By looking at water in the city as one system, holistic evaluation becomes possible leading to a more efficient and sustainable use of resources.



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

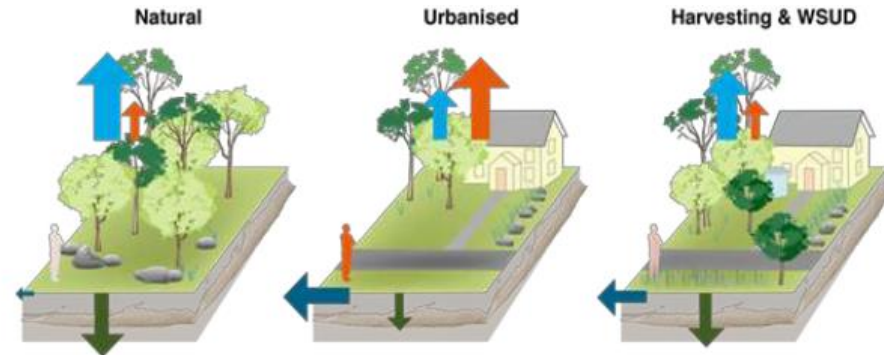
Strategic Planning

- Strategic planning introduces the concept of WSUD and describes how shifting from a conventional approach to urban water management towards an approach based on integration is more suitable to meet current requirements and cope with future uncertainty.
- It also demonstrates how greater integration can be realised in practice through the adoption of a strategic planning process. Rather than investing in short-term solutions that focus solely on today's problems, the development and implementation of a strategic plan provides the framework for making sustainable urban water management a reality.



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

Module 1: Strategic Planning



Stream channel form and biodiversity			
Groundwater recharge	High	Low	Moderate
Evapotranspiration	High	Low	Moderate
Atmospheric heating and heat storage in buildings	Natural	Hotter	Closer to natural
Human thermal comfort	Neutral	Hot	Slightly warm
Surface runoff	Low and infrequent	High and frequent	Infrequent and moderate
Stream hydrology	Natural	'Peaky'	Moderated (both high flows and low flows)
Riparian vegetation	Intact	Degraded	Restored
Channel form	Natural	Severely degraded	Uncertain (may need intervention)

Stakeholders – Involving all the players

- Professionals in water utilities, regulators, environmentalists, government officials, tourists, urban farmers, entrepreneurs, energy providers, lawyers, communities marginalized from mainstream society: all leave their mark on water in the city. Some are users, some are decision makers – all are affected if the urban water cycle is managed poorly.
- Many institutions and individuals using or dealing with the urban water system never think about how their actions impact upon water in other locations. Water falls from the sky, comes from the tap, is supplied through pipes - and is carried away in other pipes when it is dirty or flooding the streets.
- Different bodies are in charge of making sure this happens and communication between them is kept to a minimum.



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

Module 2: Stakeholders

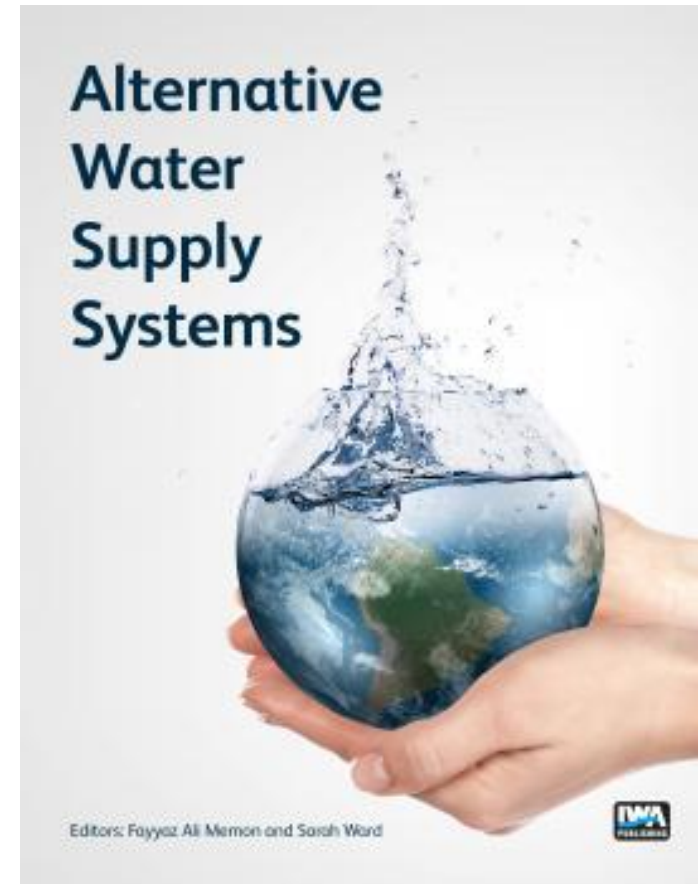
- Institutions should act together with users/developers.
- Fragmented responses delay the delivery of WSUD.
- Encourage discussion between stakeholders
- Learning Alliances stand out in times where water issues become increasingly complex.
- Learning Alliances are multi-stakeholder platforms that rely to a large degree on the participation of researchers who share their expertise in order to jointly tackle issues of common concern.



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

Module: Water Supply

- **Exploring the options:**
- As cities grow and develop, more water is needed to satisfy the increasing demands of domestic, industrial and commercial uses. Traditionally, the solution has been to dam more rivers, drill more boreholes and transfer water from neighbouring regions. But as limited resources become increasingly depleted, cities are running out of options, resulting in water scarcity and the inability to meet demand. Source pollution and the potential impacts of climate change exacerbate the problem further.
- The opposite approach is to prioritize investment in reducing demand rather than increasing supply. When combined with source protection, natural water treatment techniques and the use of alternative supplies, such an approach can protect and enhance fragile water environments, reduce service costs and energy consumption, and even contribute to flood control and improved wastewater treatment.



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

Stormwater

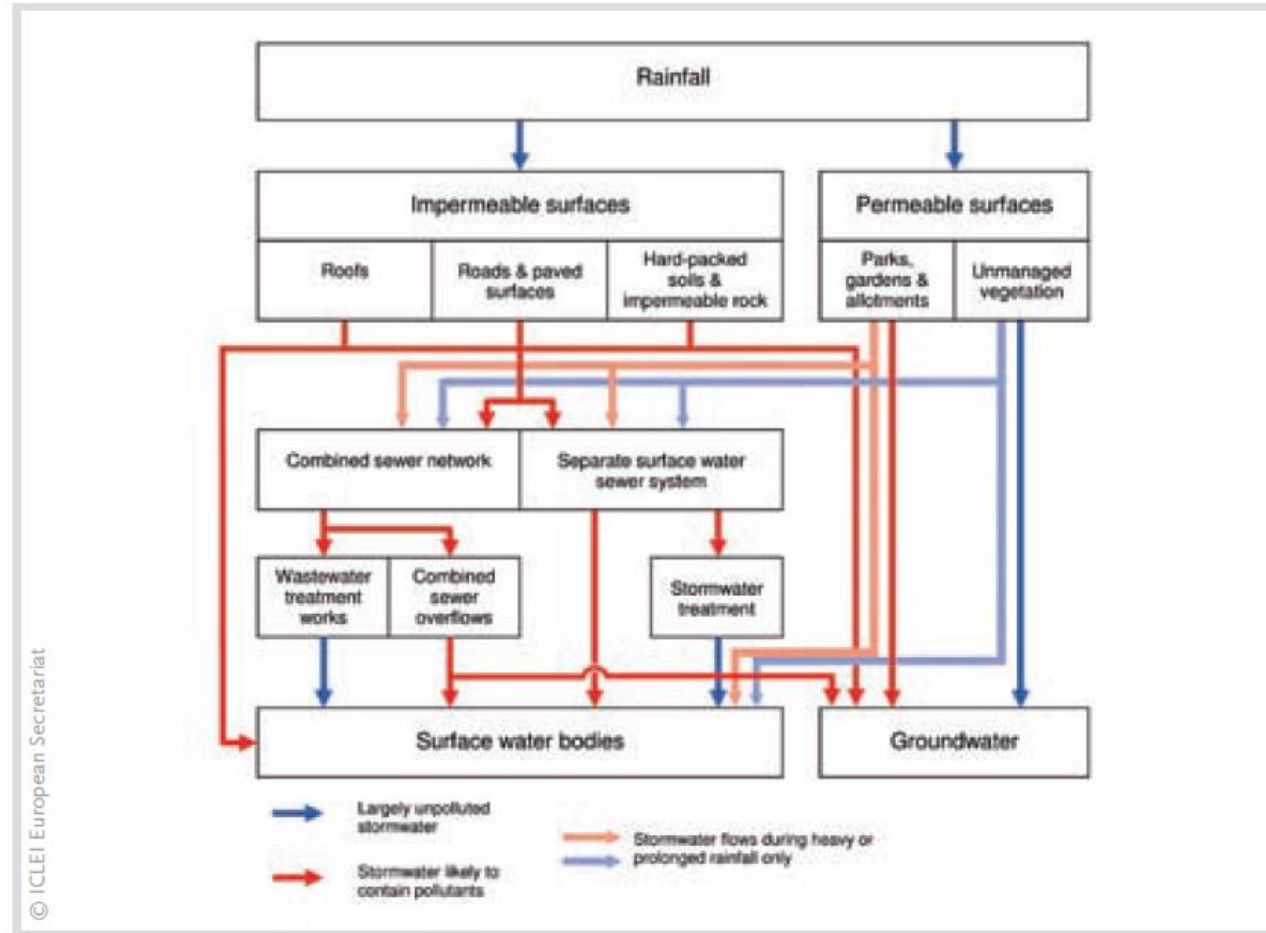
Exploring the options

- Posing a restriction to development and potential threat to infrastructure, stormwater in the city is typically considered a nuisance. The more a city grows the more problematic stormwater becomes. Urbanisation replaces vegetation with impermeable roofs, roads and paving, restricting the natural attenuation and infiltration of stormwater and creating greater volumes of runoff.
- To cope with these increased volumes, urban drainage infrastructure is designed with the aim of conveying rainfall away from the city as rapidly as possible. Taking this approach has, however, negative implications, including localised and downstream flood risk, erosion of streams and riverbanks, groundwater depletion and pollution of receiving water bodies.



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

Stormwater Flow Chart



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

Stormwater

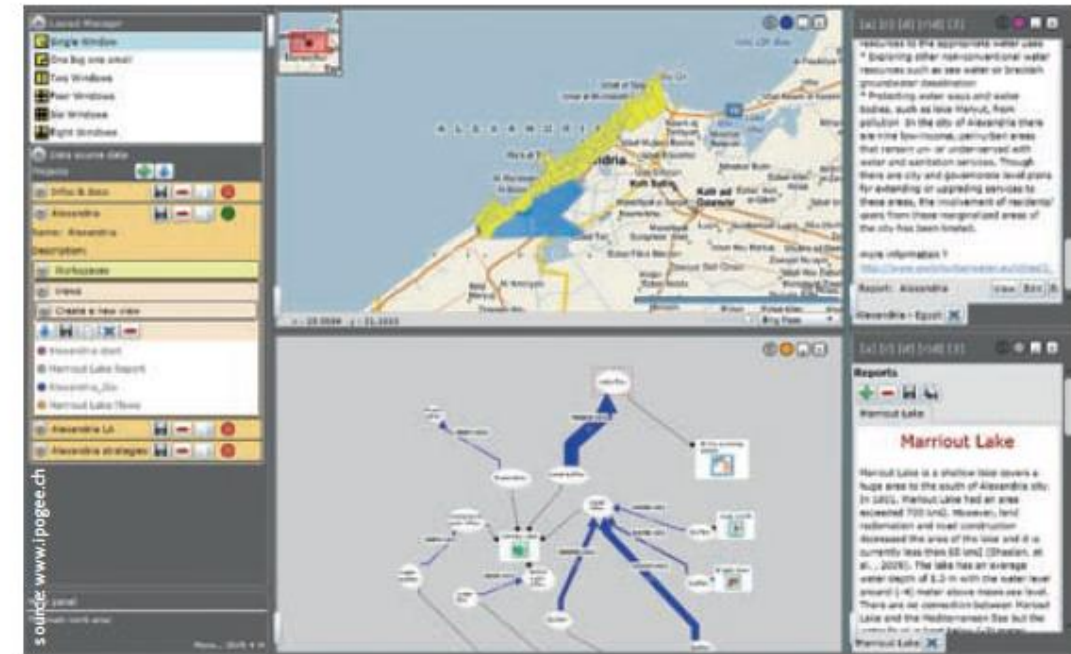
- Alternatively, stormwater can be approached and managed *not as a nuisance but rather as a resource*. By attenuating, infiltrating and reusing rainfall runoff within the city, stormwater management can become an attractive and beneficial feature of the urban landscape.
- problems caused by conventional urban drainage methods and explains the benefits of integrating stormwater with other sectors of water management and urban design. These include flood risk management, environmental protection, urban regeneration and the alleviation of water scarcity.
- sustainable urban drainage solutions, such as the use of ponds and wetlands for stormwater retention, vegetation and soils for attenuation, and aquifers for infiltration and reuse. It goes on to demonstrate how these can positively influence urban water management and city development as a whole.



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

Module 5: Decision Support Tools

- Choosing a sustainable path
- Due to the large investment costs and long life span of pipelines, reservoirs and treatment plants, long-term planning is a vital aspect of urban water management. Traditionally, investment and planning decisions are taken independently within different sectors, based on narrowly defined aims and implementation costs. Quantified data and future forecasts are used to identify a solution that addresses a current or anticipated problem under presumed conditions.
- This approach leads to the *selection of solutions that are optimal for a confined area and specific goal of urban water management*. However, it typically lacks the scope to also identify negative knock-on effects – as well as benefits – elsewhere in the system, since it fails to assess the urban water cycle as a whole. In addition, the faith placed in future predictions tends to favour rigid solutions only capable of operating within a rather limited range of variability.



www.switchurbanwater.eu/outputs/pdfs/W5-1_GEN_MAN_D5.1.5_Manual_on_WSUD.pdf

WSUD: The UK Experience

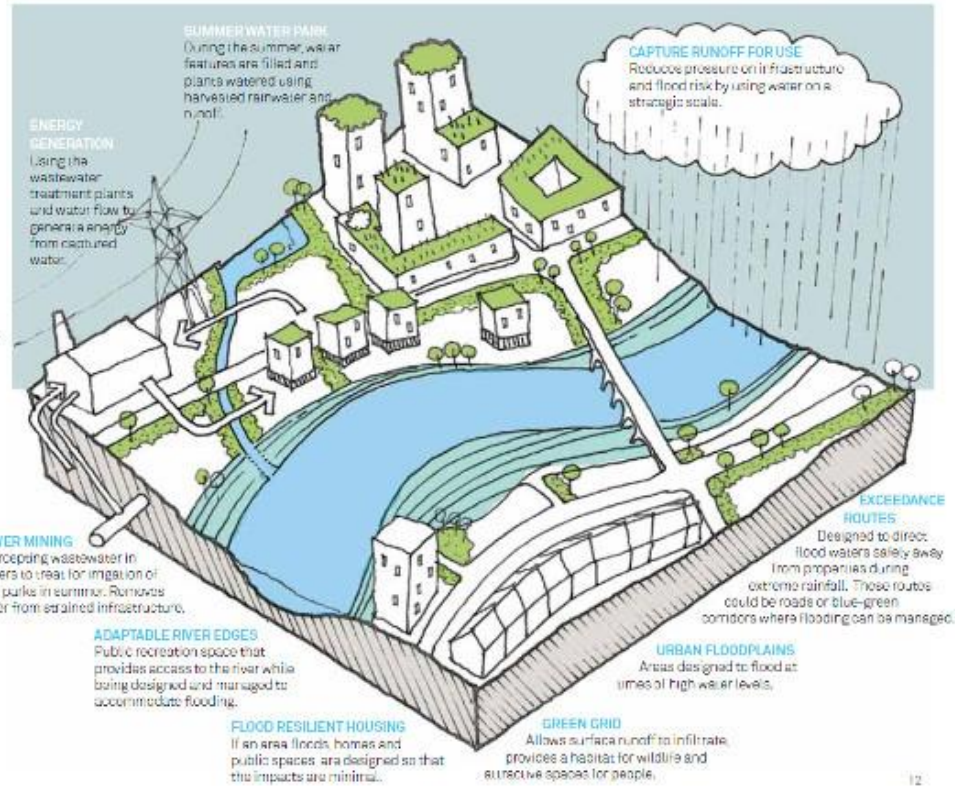
WHAT COULD A WATER SENSITIVE CITY LOOK LIKE?

URBAN FORM:
Large urban area centred on river corridor
City centre dominated by paved areas
Significant growth targets

WATER CONTEXT:
Lack of capacity in sewer system
Serious flood risk
High rainfall and low water stress

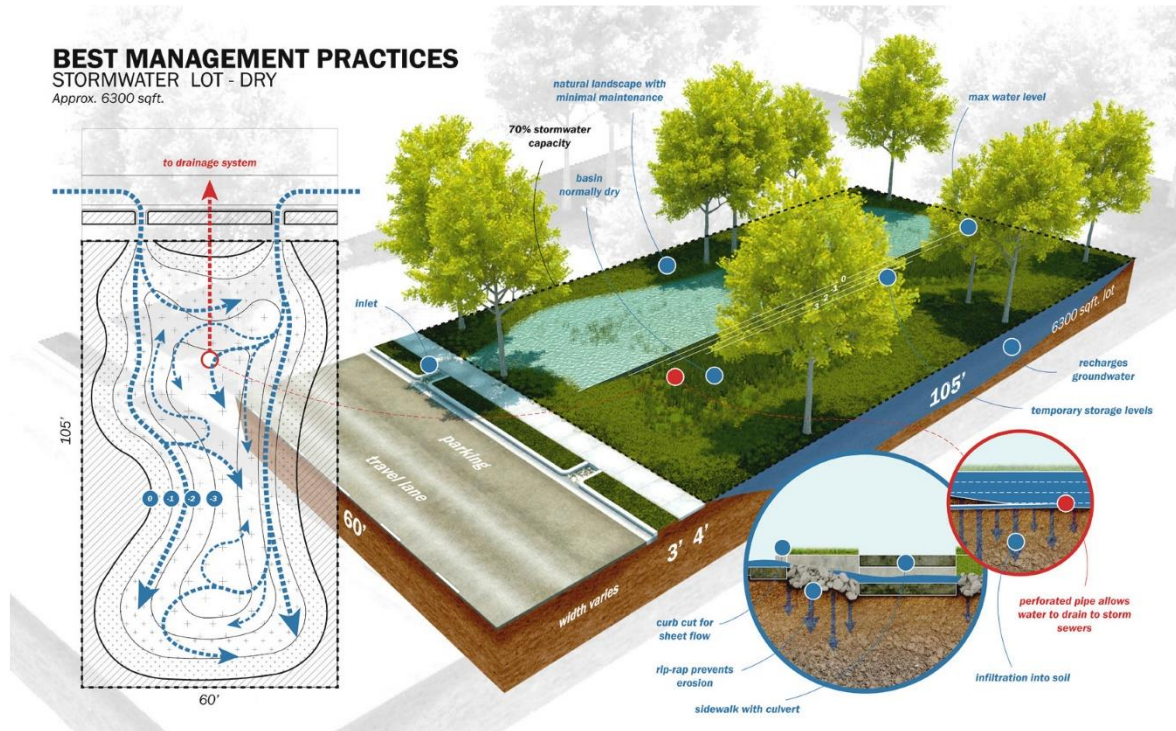
COMMUNITY CONTEXT:
Hotspots of deprivation
Neighbourhood parks and recreation spaces needed

water
sensitive
urban
design



https://www.ciria.org/Resources/Free_publications/Water_Sensitive_Urban_Design.aspx

WSUD: The Netherlands Experience

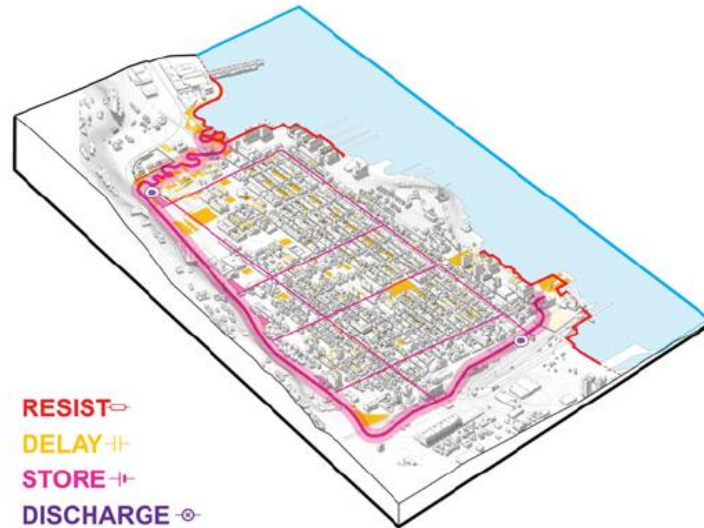


WSUD: The Netherlands Experience



<http://www.urbanisten.nl/wp/?portfolio=waterplein-benthemplein>

WSUD: The USA Experience



https://watersensitivecities.org.au/wp-content/uploads/2016/07/TMR_B412_adaptation_mainstreaming_.pdf

WSUD: The USA Experience



NYC Waterfront Revitalization (Community spaces and Urban Farming)

WSUD: The USA Experience



Animated Film Envisions BIG's Manhattan "Dry Line"

00:00 - 17 February, 2015



<https://www.archdaily.com/tag/rebuild-by-design/>

WSUD in Australia: Origins and evolution

- Rapid urbanization and sprawl, cities extending into former agricultural and forestry land
- Change in the Water Cycles in Urban areas
- First approach: Design of stormwater management systems to convey stormwater runoff directly to the streams, no focus in Ecosystem preservation
- Urban Stream Syndrome: Stream carrying pollutants and sediments and suspended solids
- 1960 increasing recognition of Urban Stream Syndrome lead to a more holistic stormwater approach in Australia
- 1990: Increase of awareness with CRC programs
- Australia arid conditions make it particularly vulnerable to climate change and reliability of water sources
- 1994: Western Australia released the first WSUD Guidelines , other states followed in the next years (NSW, Victoria, Queensland)
- 2004 National Water Initiative (NWI): Comprehensive national strategy to improve water management across the country
- 2010-onwards: Councils released their own WSUD customized for its own context and population (Melbourne, Port Phillip, Moreland, etc).
- 2012: CRC for Water Sensitive Cities

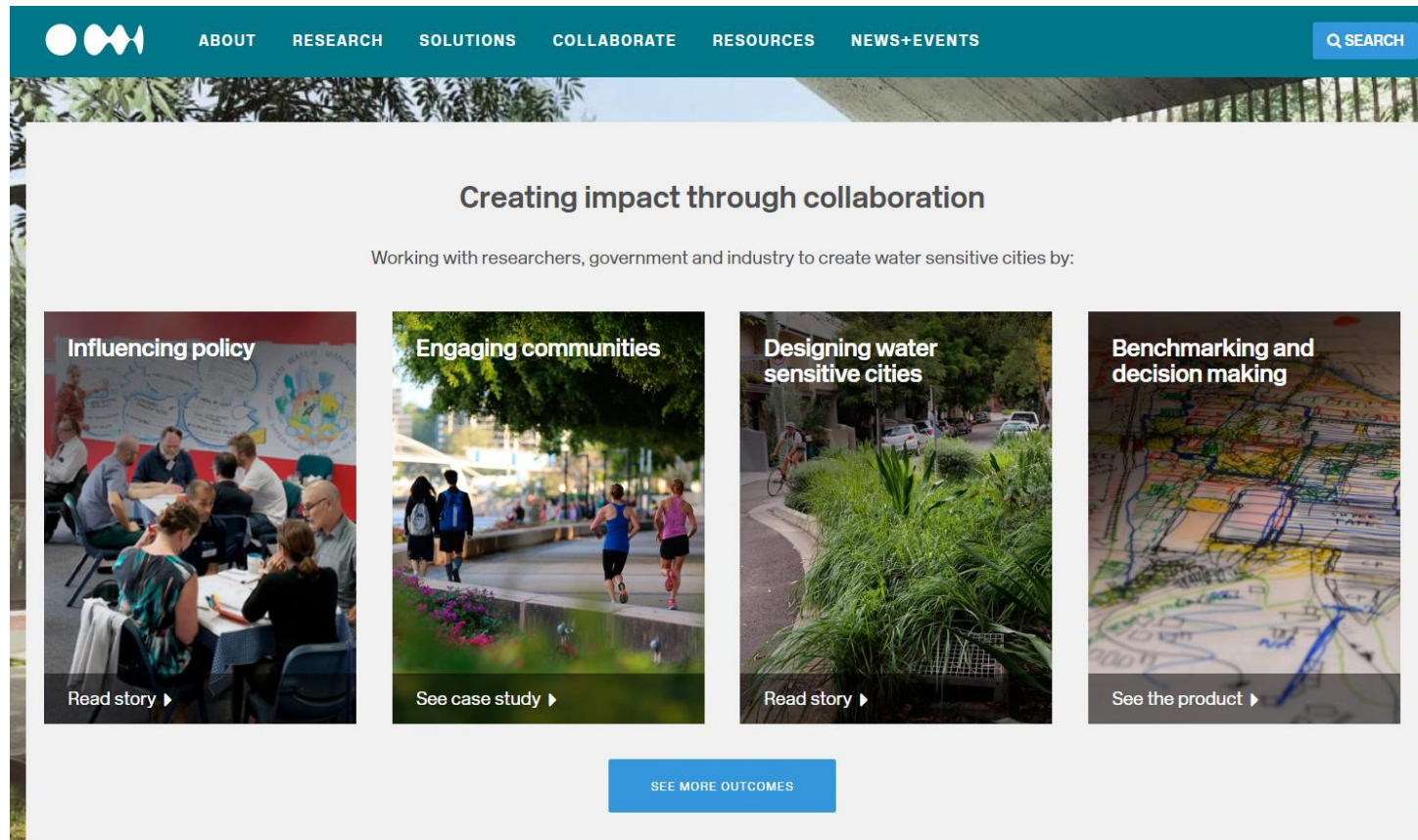


WSUD in Australia: Research and Guidelines

- Australian government committed to support the process of adoption of WSUD – CRC for Water Sensitive Cities in 2012
- Local Governments released guidelines for implementation and design and Federal and National governments integrate WSUD into their planning process.
- Adoption of WSUD is voluntary, councils promote their implementation and some have incentives (Development Rights, Tax cuts, accreditation).

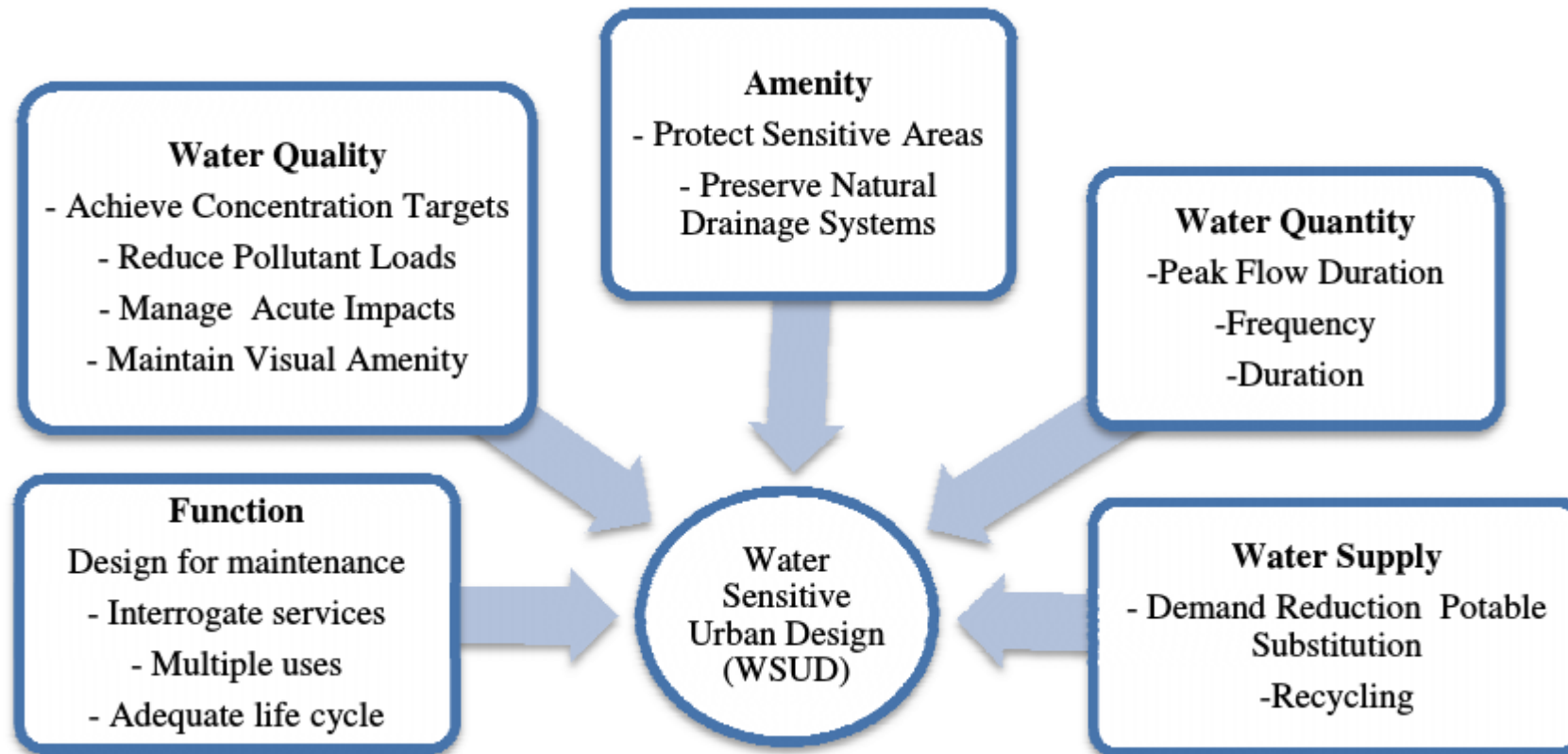


WSUD in Australia: CRCWSC Strategy



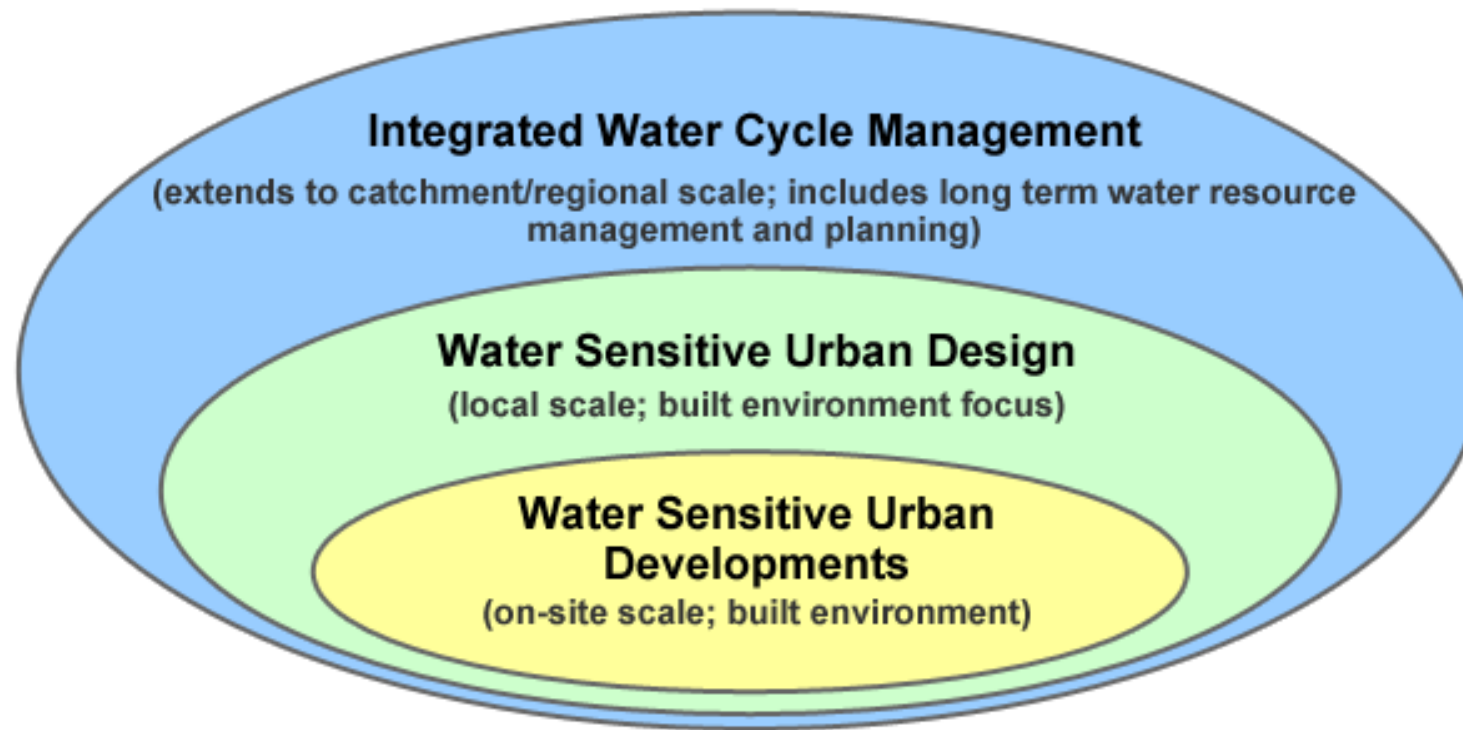
<https://watersensitivecities.org.au/>

WSUD in Australia: Framework Components



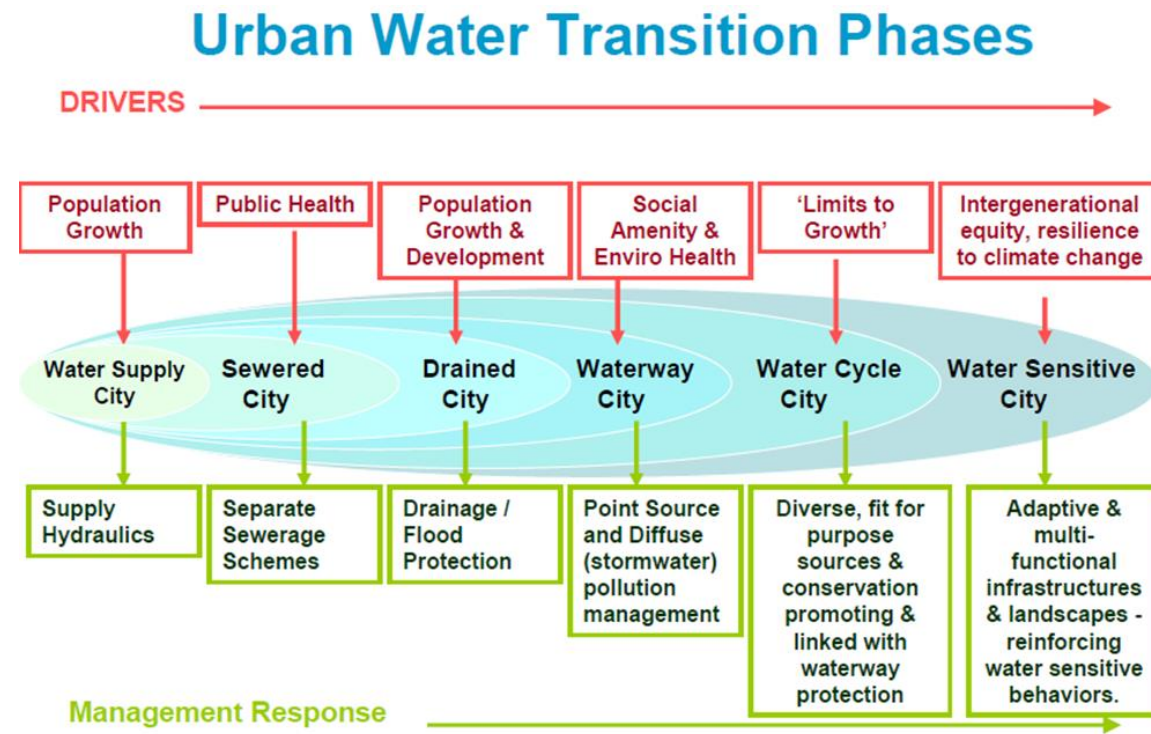
https://www.researchgate.net/publication/263426255_The_role_of_green_roofs_in_Water_Sensitive_Urban_Design_in_South_Australia

WSUD Framework: From Building to Catchment



<https://www.newwaterways.org.au/about-us/water-sensitive-urban-design/>

WSUD Framework: Water transition and Leapfrogging

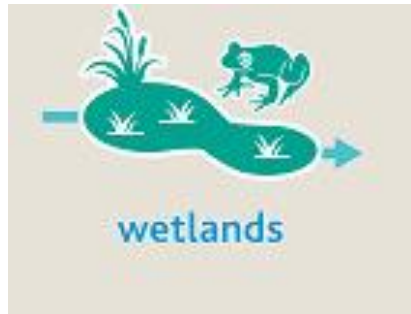


http://www.switchurbanwater.eu/outputs/pdfs/W1-3_GEN_MAN_D1.3.3_SWITCH_Transition_Framework.pdf

WSUD Options:

WSUD options

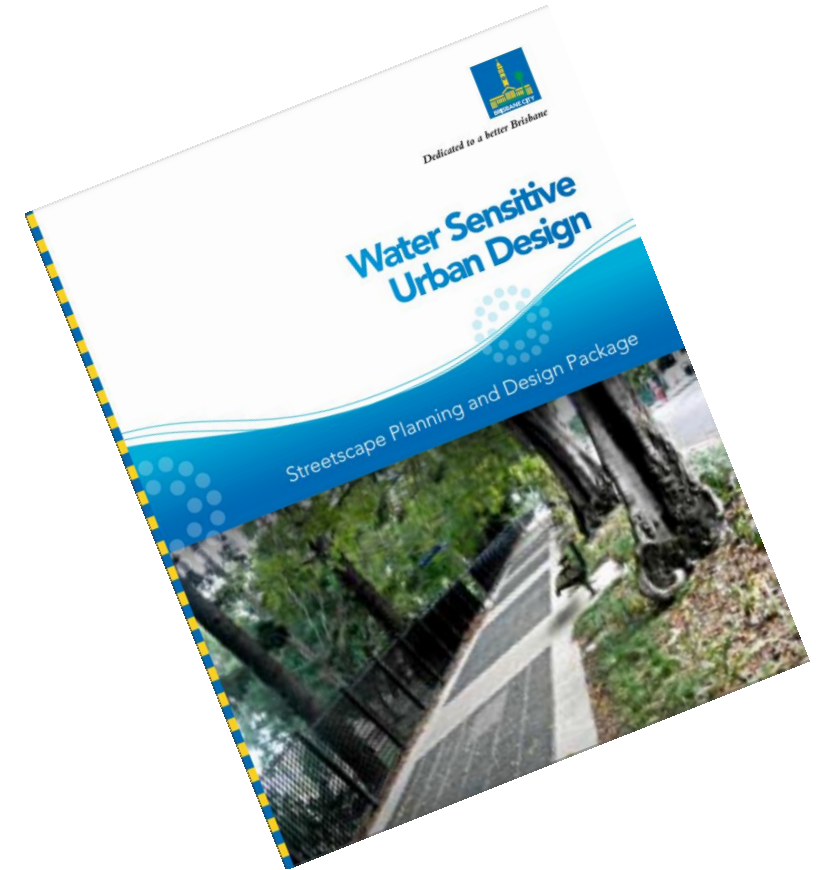
WSUD works at all levels – lot, street and precinct – as well as regional scales. It includes a range of treatment options:



<https://www.melbourne.vic.gov.au/building-and-development/sustainable-building/Pages/water-sensitive-urban-design.aspx>

WSUD Concept Design:

- **Concept design**
- The concept design stage involves selecting the type, location and approximate size of stormwater treatments. It focuses on understanding site opportunities and constraints, identifying a preferred treatment type and design configuration, and confirming there is adequate land available. At the end of this stage, your council and/or Melbourne Water should agree on the design objectives and indicative stormwater treatment footprint, subject to the functional design.
- **Design objectives**
- **Concept design package**
- **Submission requirements**
- Developers designing wetlands that will be handed over to Melbourne Water for operation and maintenance must use the Constructed Wetlands Design Manual. The following requirements are typical for concept design submissions. Depending on the scale and type of treatment, some or all of these may be relevant for the design and required by the approving authority.



<https://www.melbourne.vic.gov.au/building-and-development/sustainable-building/Pages/water-sensitive-urban-design.aspx>

Functional Design Guidelines

- **Functional design**
- The functional design stage contains the next level of detail following the approved concept design. It involves designing all functional elements of the system, including: calculations for levels and pipe sizes of all inlet and outlet structures modelling for hydrology, hydraulics and water quality design refinement to account for detailed information such as the survey It's important to have a project hold point at the functional design stage, so that the modelling assumptions and designed water depths can be checked.
- **Design objectives**
- **Functional design package**
- **Submission requirements**
- Developers designing wetlands that will be handed over to Melbourne Water for operation and maintenance must use the Constructed Wetlands Design Manual.
- The functional design package must contain all relevant elements of the concept design as well as the following requirements. Depending on the scale and type of treatment, some or all of these may be relevant for the design and required by the approving authority.



<https://www.melbourne.vic.gov.au/building-and-development/sustainable-building/Pages/water-sensitive-urban-design.aspx>

WSUD Case Studies and Check lists

- **Case studies and checklists**
- The following checklists, design examples and case studies have been developed by Melbourne Water for use by councils. They are intended to help improve outcomes at the hold point stages in capital works and developer constructed projects.
- **Sediment ponds**
- Design checklist
- Construction checklist
- Handover checklist
- Maintenance checklist
- Resetting sediment ponds - Best practice guide
- **Constructed wetlands**
- **Raingardens**



<https://www.melbourne.vic.gov.au/building-and-development/sustainable-building/Pages/water-sensitive-urban-design.aspx>

WSUD Maintenance and Inspection

- **WSUD Maintenance - Inspection and maintenance activity guidelines**
- **Swales**
- Design checklist
- Construction checklist
- Handover checklist
- **WSUD Maintenance - Inspection and maintenance activity guidelines**
- Stormwater harvesting
- Concept design - case study



<https://www.melbourne.vic.gov.au/building-and-development/sustainable-building/Pages/water-sensitive-urban-design.aspx>

Issues affecting decision-making in WSUD

Major issues affecting the adoption of WSUD include:

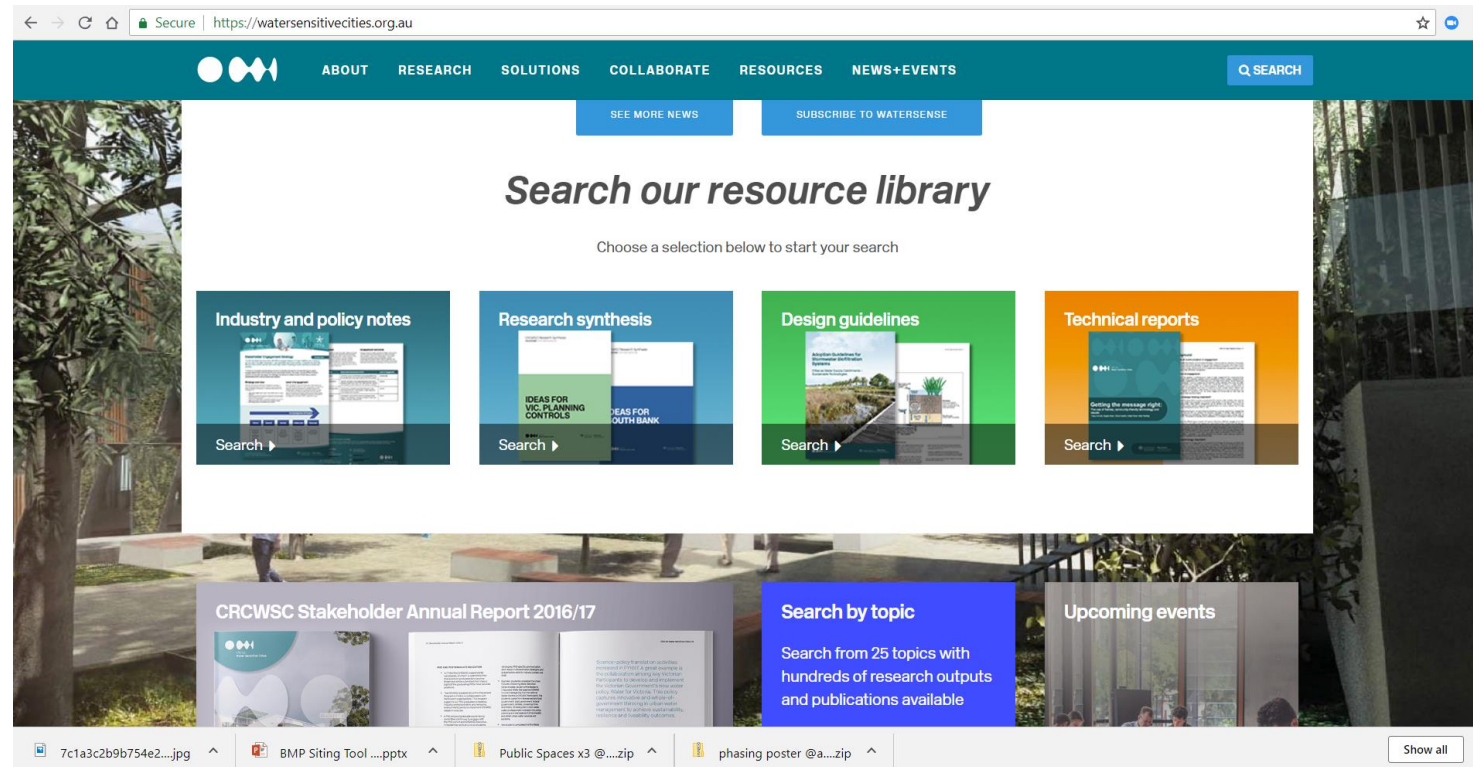
- Regulatory framework barriers and institutional fragmentation at state and local government levels;
- Assessment and costing uncertainties relating to selecting and optimizing WSUD practices for quantity and quality control;
- Technology and design and complexity integrating into landscape-scale water management systems; and
- Marketing and acceptance and related uncertainties.

The transition of Melbourne city to WSUD over the last four decades has culminated in a list of best practice qualities and enabling factors, which have been identified as important in aiding decision making to facilitate transition to WSUD technologies. The implementation of WSUD can be enabled through the effective interplay between the two variables discussed below



<https://www.melbourne.vic.gov.au/building-and-development/sustainable-building/Pages/water-sensitive-urban-design.aspx>

Want to know more?: CRC for Water Sensitive Cities Resource Library



<https://watersensitivecities.org.au>

Group Activity: Evaluation of WSUD in 2 Case Studies in Bogor

- Objective: Get the participants feedback from the WSUD proposals for 2 of our Case Studies in Bogor: *Pulo Geulis and Situ Front City in Cibinong*.
- Explore possible alternatives for better implementation of WSUD in Bogor
- Discuss the WSUD proposals scope, urban approach and Green Technology solutions.



WSUD Evaluation Matrix

- The general group will be divided into 4 groups, each participant can select the Case Study according to his/her own interest.
- The facilitator will introduce the main components of the proposal and fill together with the participants the WSUD Evaluation Matrix
- Printed posters in each table will give more information to participants regarding the context and urban design approach for each Case Study.
- Duration: 1 hours
- Reporting back: 30 mins

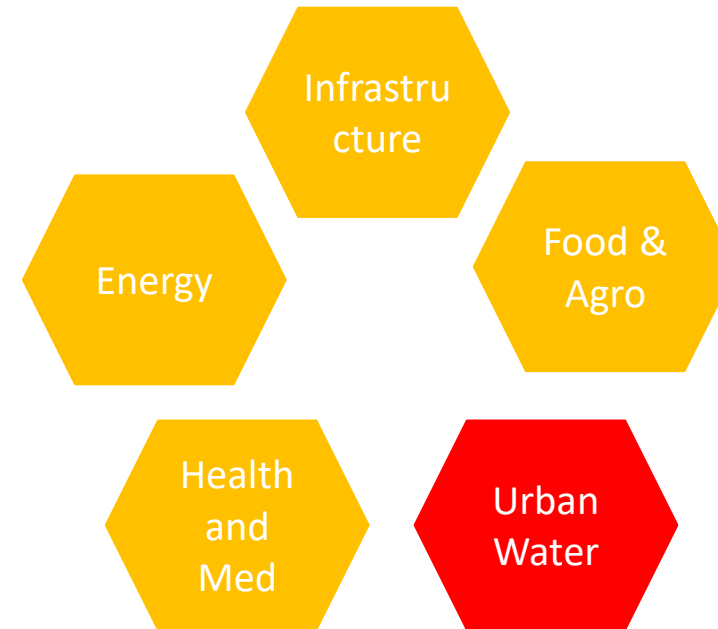
PULO GEULIS CASE STUDY WATER SENSITIVE URBAN DESIGN EVALUATION MATRIX						
	Environmental Advantages/disadvantages	Social Advantages/disadvantages	Economical Advantages/disadvantages	Challenges in Implementation	Suggestions for overcoming challenges	Related Regulations/policies to consider
FUNCTION Design for Maintenance Multiple Uses Adequate life Cycle Adaptable						
WATER QUALITY Achieve concentration targets Reduce pollutant loads Manage Acute Impacts Maintain Visual Amenity						
AMENITY Protect Sensitive Areas Preserve Natural Drainage System Accessible						
WATER QUANTITY Peak Flow Duration Frequency Reliability						
WATER SUPPLY Demand Reduction Potable Water Substitution Recycling						

Australia-Indonesia Centre

The Australia-Indonesia Centre is an initiative of:



Research collaborations in:



The Australia-Indonesia Centre is a collaboration between the following Participating Institutions



working in partnership with seven leading universities in Indonesia



and recognises the valuable support of the following Corporate Partners





**UNIVERSITAS
INDONESIA**
Veritas, Probitas, Iustitia

For more information, Please contact us:

By Email:

urbanwater@australiaindonesiacentre.org

jane.holden@monash.edu;

Dwi.Yuliantoro@australiaindonesiacentre.org

In our Webpage:

www.urbanwater.australiaindonesiacentre.org

Follow us in Twitter: @Urban_Water