



# **Water Cycle Safety Planning (WCSP): general outline of the concept**

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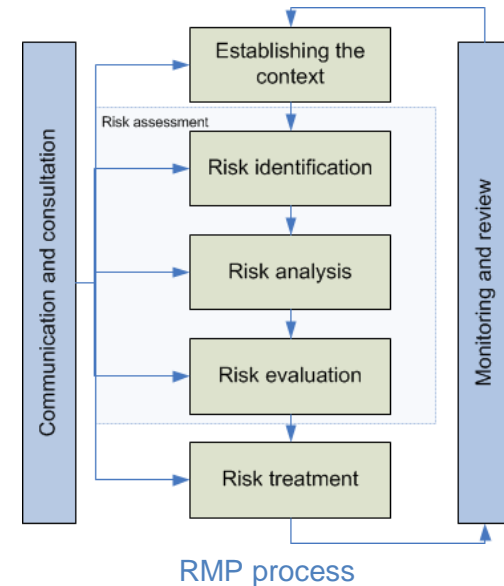
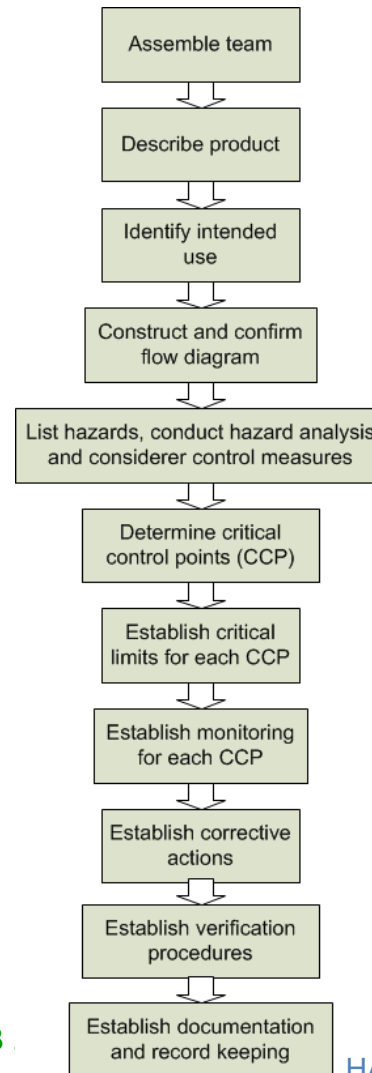
- 1 | Background
- 2 | WCSP scope and primary aims
- 3 | WCSP development criteria
- 4 | WCSP framework overview
- 5 | Advantages of adopting the WCSP framework
- 6 | Lessons from demonstrations



# 1 | Background

## Risk driven frameworks and strategies for urban water utilities

- Risk Management Framework (RMF)  
(IEC,1995; ISO31000:2009; ISO Guide 73:2009)
- Hazard Analysis and Critical Control Points (HACCP) (Codex, 2003)
  - » ISO 22000:2005
- Water Safety Plans (WSP)  
(WHO, 2005; WHO, 2009)
- EU project Techneau





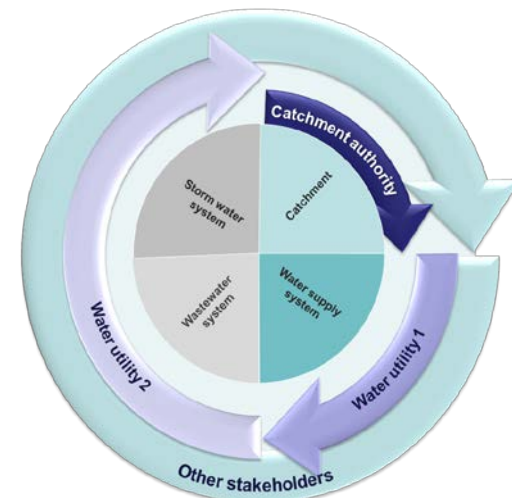
## Aspects common to frameworks analysed to deal with water supply safety

- preventive and systematic risk approach for managing risk
- use of a multi-barrier approach to control risks
- end-product testing complemented by a process control approach (risks from source to tap)
- mainly directed at quality aspects and not quantity
- importance of periodic reviews
- importance of co-operation between stakeholders
- importance of communication inside and outside the organizations



## Main aspects not included in WSP compared to RMP

- Use of risk instead of hazard as focus of the analysis is perhaps the most relevant difference
- Using **risk** allows **identification** process to be more comprehensive
  - hazard + risk sources, risk factors and events
- Using **risk**, both likelihood and consequences of the events corresponding to the risks identified are evaluated
- **Risk evaluation** - decision on risks that need treatment, based on the comparison of risk analysis results with set criteria is essential to deal with risks that cannot be controlled using predetermined targets
- WSP tailored to water supply systems





# 2 | WCSP scope and primary aims



## WCSP expanded scope

- ▶ Urban water systems
- ▶ Strategic objectives of utilities
- ▶ EU Directives

## WSP aims

- ▶ Protection of public health
- ▶ Drinking water supply systems
- ▶ Exposure modes: consumption of tap water

## EU Directives

Drinking Water Directive  
 Bathing Water Directive  
 Wastewater Treatment Directive  
 Floods Directive  
 Water Framework Directive

## Territory management

Protection of public health  
 Safeguard public safety  
 Protection of surface and groundwater

## Utilities objectives

Fulfil needs and expectations of consumers/users  
 Sustainable use of resources (water, energy, ...)

EN 752

ISO 24500

Sustainability of the service  
 Continuity of service



# 2 | WCSP scope and primary aims



## WCSP primary aims

- ▶ “water safety” to people and to the environment
- ▶ urban water systems
- ▶ water cycle systems managers’ point of view

Primary aim	Exposure to hazards	Generic / typical hazards
Protection of public health	<ul style="list-style-type: none"> <li>▪ Consumer /user</li> <li>▪ Recreational user</li> <li>▪ Public</li> </ul>	<ul style="list-style-type: none"> <li>▪ Non-safe water at consumption or use</li> <li>▪ Polluted water when bathing (microbial, chemical contamination)</li> <li>▪ Flooding (water with sewage)</li> </ul>
Protection of public safety	<ul style="list-style-type: none"> <li>▪ Consumer / user</li> <li>▪ Public</li> <li>▪ Utility worker*</li> </ul>	<ul style="list-style-type: none"> <li>▪ Infrastructure collapses /bursts</li> <li>▪ High velocity surface flow</li> <li>▪ Chemical spillage</li> </ul>
Protection of environment	<ul style="list-style-type: none"> <li>▪ Receiving water bodies</li> <li>▪ (Soil, air)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Overuse of resources</li> <li>▪ Pollution affecting ecological or chemical status</li> <li>▪ GHG</li> </ul>

\*In general, these issues are dealt with by health and safety legislation, thus not necessarily included in WCSP unless specific conditions occur



## 3 | WCSP development criteria

- **Expand the WSP approach** ▶ keeping some compatibility
- **Risk process based approach** ▶ compatible with other risk based processes in water utilities
- **Harmonising risk terminology** ▶ simplifying application
- **Promote stakeholders collaboration** ▶ effective cooperation (shared aims, data, operational practices, measures, costs)
- **Framework applicable to utility objectives** ▶ other than climate related

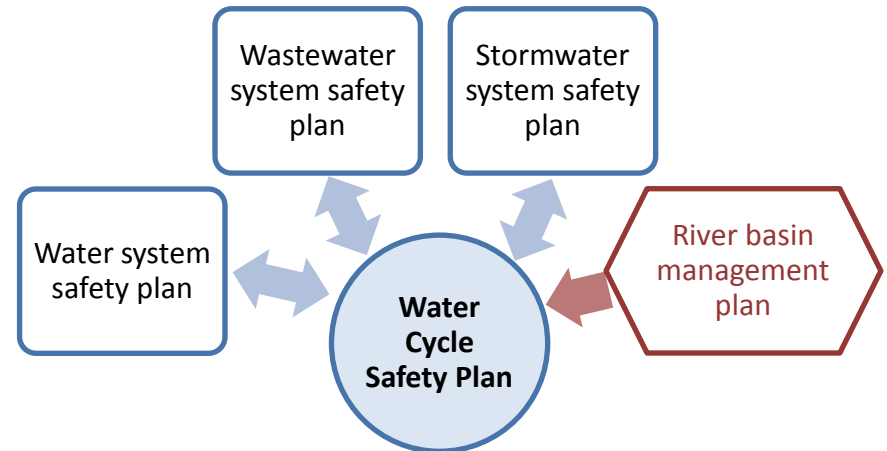






## ▶ Two levels of action

- » **Water cycle integrated level** ▶ issues dealt with at a macro scale and interactions between systems are considered
- » **System level** ▶ detailed analysis



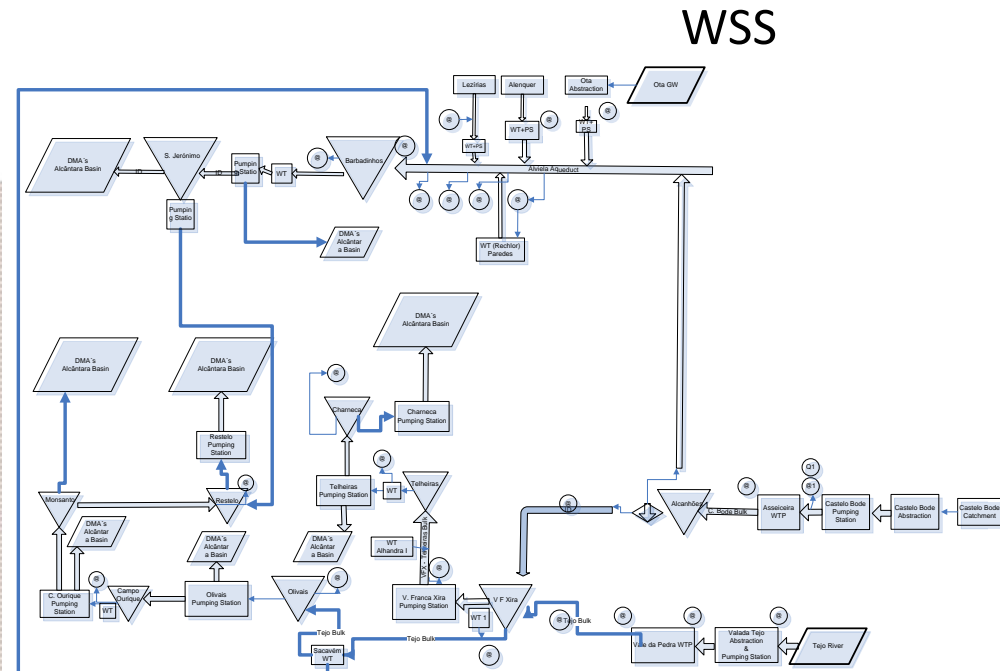
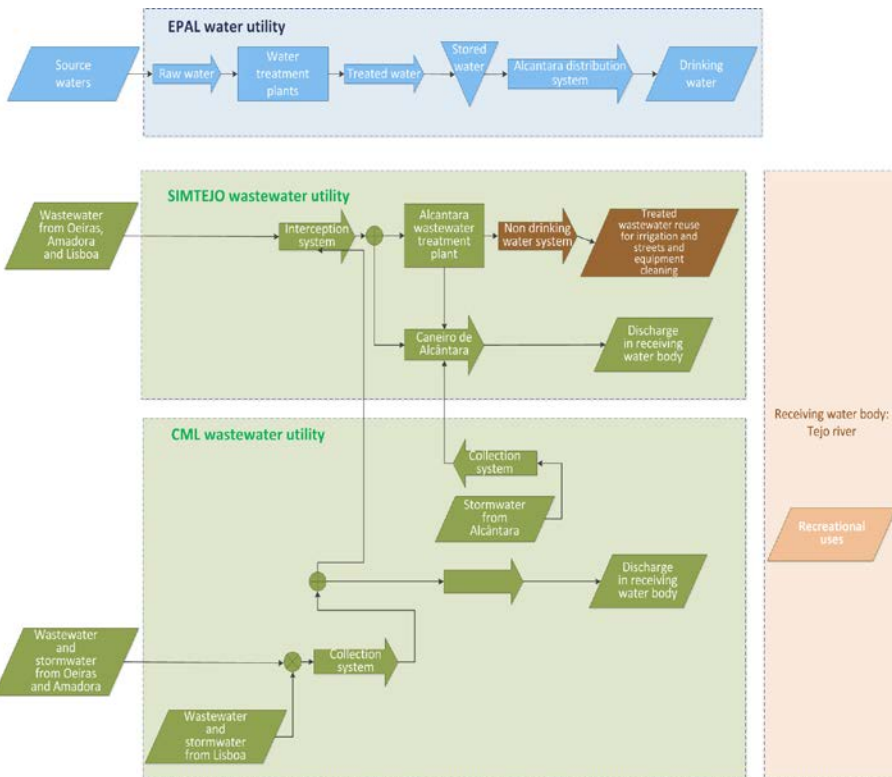


# 4 | WCSP framework overview

## Two levels of action

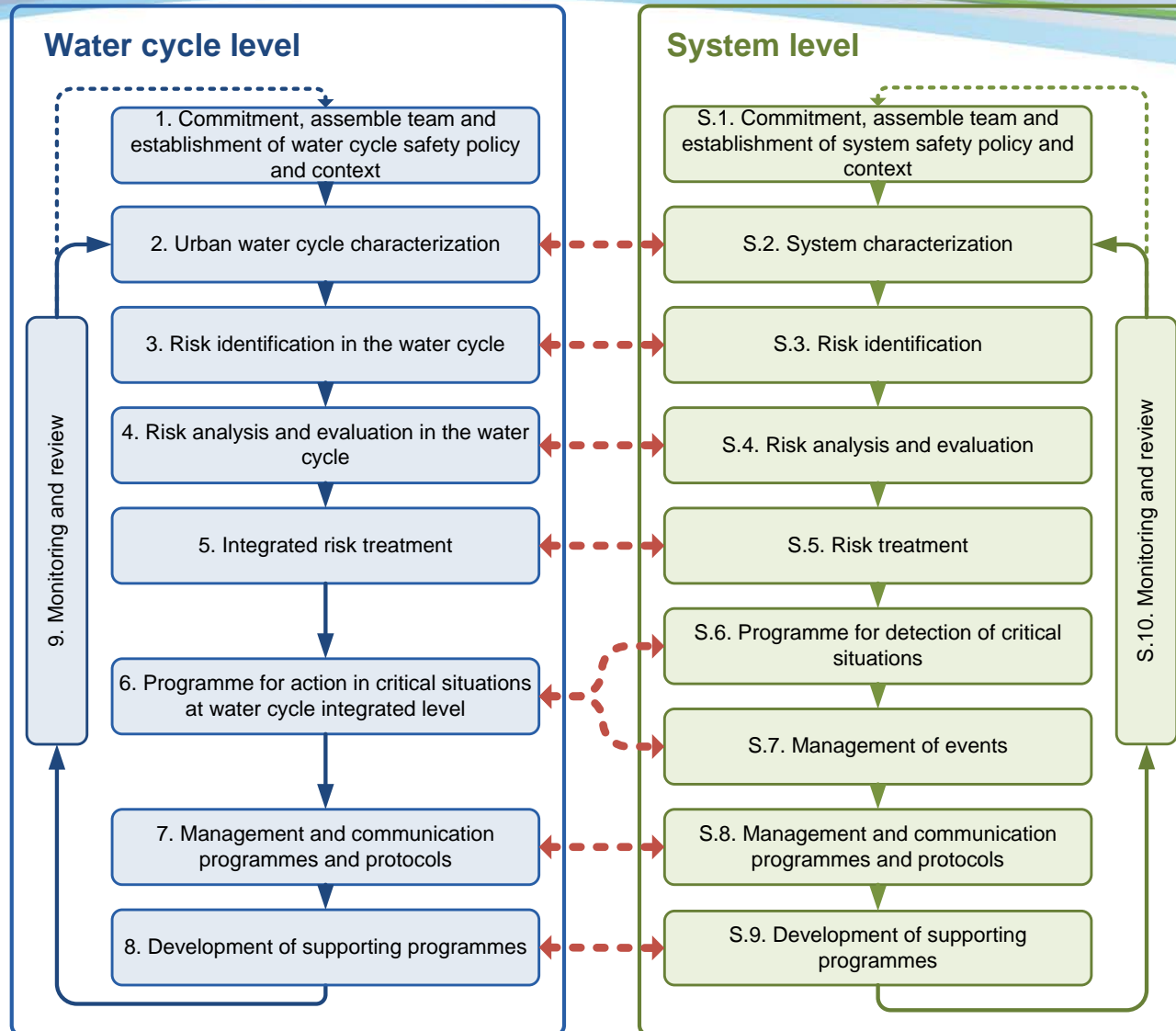
### Water cycle integrated level

### System level





# 4 | WCSP framework overview

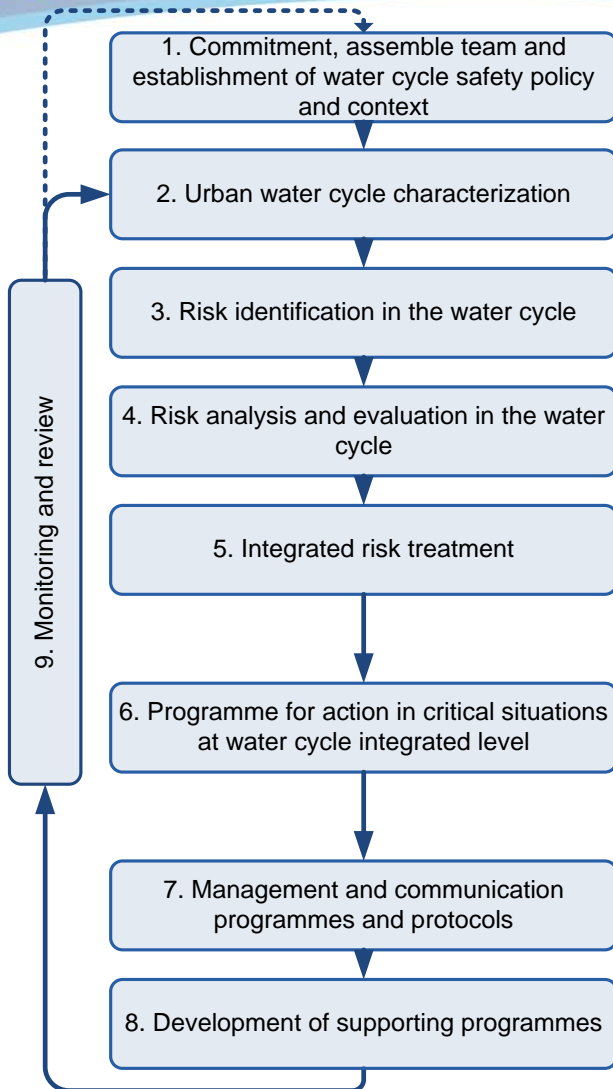


**Legend**

- Organisational loop
- Regular process loop
- Interaction between levels



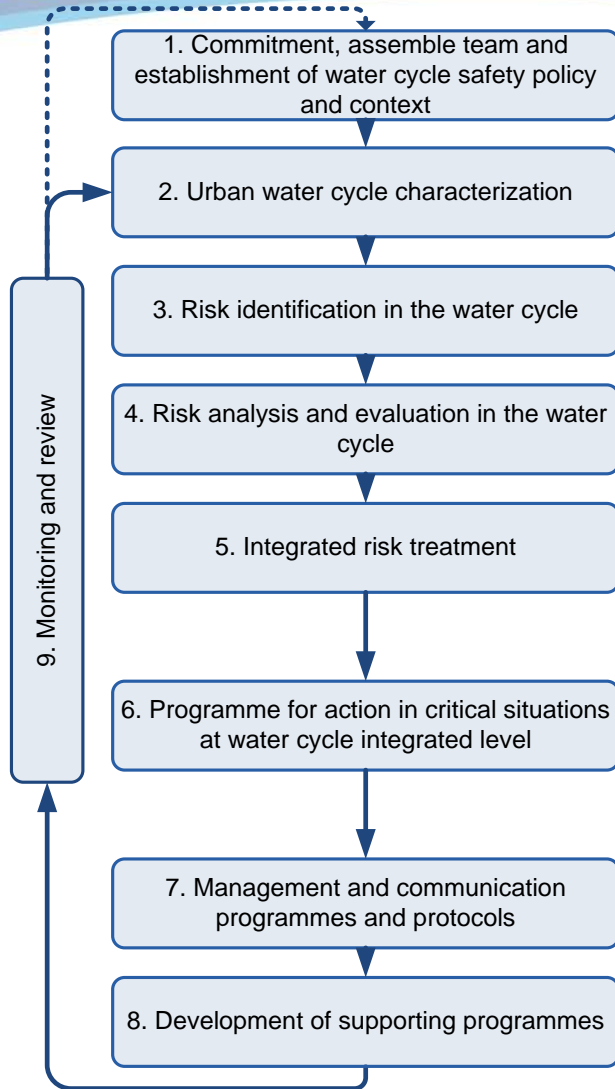
# 4 | WCSP framework overview



Step	Key actions
1.	<ul style="list-style-type: none"> <li>▶ Identify stakeholders, assemble team and ensure commitment</li> <li>▶ Establish the water cycle safety policy</li> <li>▶ Establish the context               <ul style="list-style-type: none"> <li>– Compile formal requirements</li> <li>– Understanding the internal context</li> <li>– Define the time schedule to develop the WCSP</li> <li>– Define the context for risk assessment</li> <li>– Set criteria for risk assessment</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>▶ Identify and describe water cycle components and interactions               <ul style="list-style-type: none"> <li>– Construct a water cycle flow diagram</li> <li>– Describe the urban water systems</li> </ul> </li> </ul>
	<ul style="list-style-type: none"> <li>▶ Identify criteria and targets for products and services</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Identify relevant hazards, risk sources and risk factors</li> </ul>
3.	<ul style="list-style-type: none"> <li>▶ Assess the potential effect of climate change trends</li> <li>▶ Explore scenarios and potential events</li> </ul>
	<ul style="list-style-type: none"> <li>▶ Assess the likelihood and consequences for each event</li> </ul>
4.	<ul style="list-style-type: none"> <li>▶ Estimate the level of risk for each event</li> <li>▶ Evaluate risk for each event</li> <li>▶ Compare and reassess estimated risks</li> </ul>



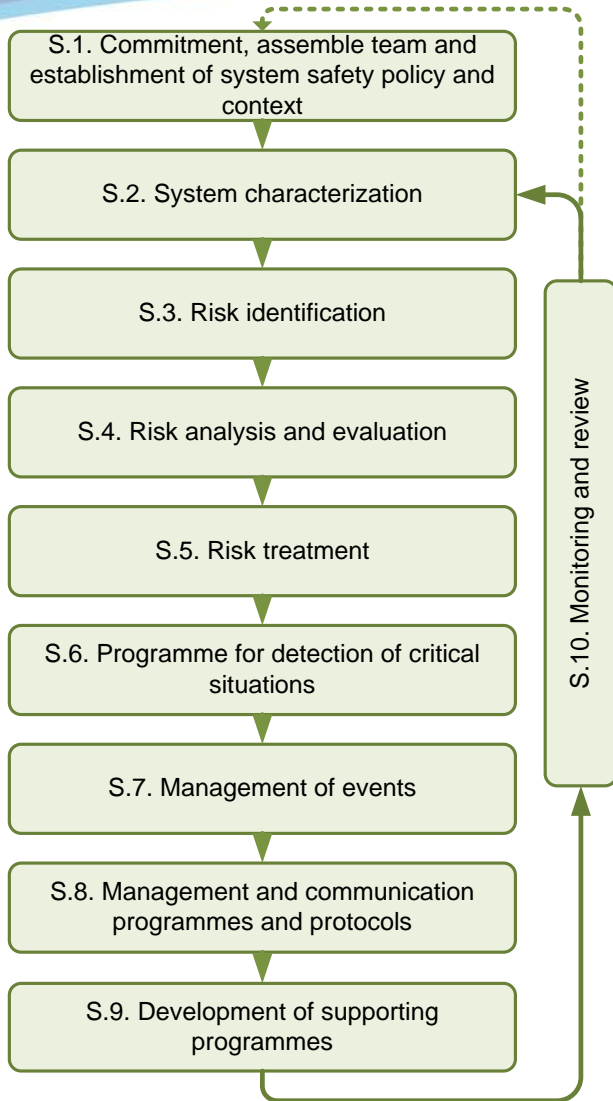
# 4 | WCSP framework overview



Step	Key actions
	<ul style="list-style-type: none"> <li>▶ Identify risk reduction measures</li> </ul>
5.	<ul style="list-style-type: none"> <li>▶ Assess alternatives, prioritize and select risk reduction measures</li> <li>▶ Assess residual risk</li> <li>▶ Develop a risk treatment programme</li> </ul>
6.	<ul style="list-style-type: none"> <li>▶ Review and adjustment of operational monitoring procedures</li> <li>▶ Establish corrective actions</li> <li>▶ Develop an emergency response plan</li> </ul>
7.	<ul style="list-style-type: none"> <li>▶ Develop and implement communication programmes and protocols</li> <li>▶ Develop and implement management programmes and protocols</li> <li>▶ Review management and communication programmes and protocols</li> <li>▶ Record the risk management process at water cycle integrated level</li> </ul>
8.	<ul style="list-style-type: none"> <li>▶ Identify and develop supporting programmes needed for the implementation of the WCSP</li> <li>▶ Review supporting programmes</li> <li>▶ Define tasks and responsibilities</li> </ul>
9.	<ul style="list-style-type: none"> <li>▶ Keep the WCSP up to date</li> <li>▶ Record and report results</li> </ul>



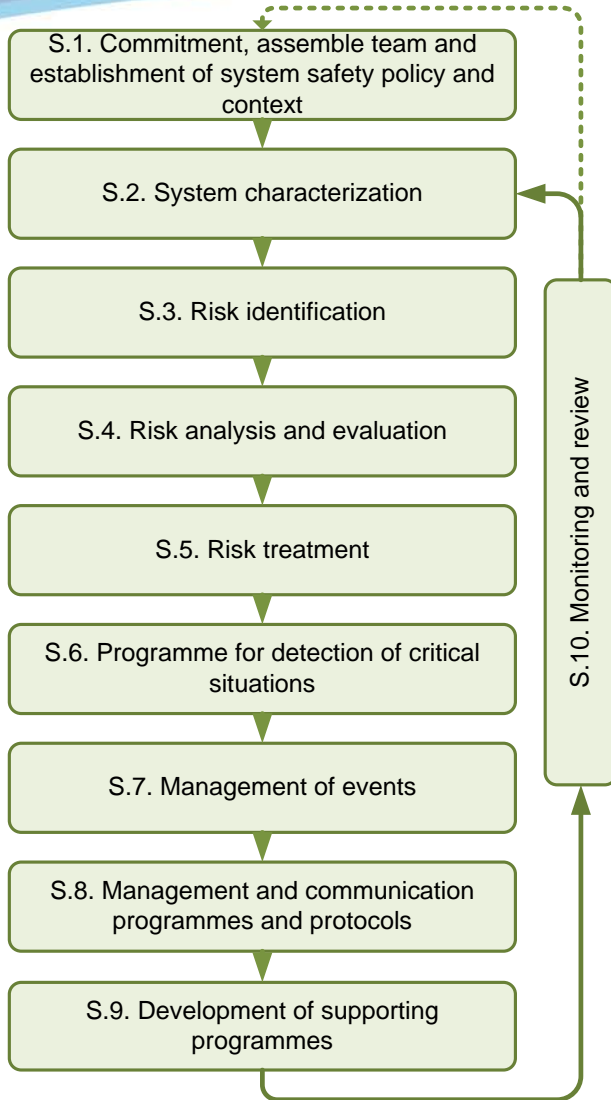
# 4 | WCSP framework overview



Step	Key actions
<b>S.1.</b>	▶ Identify necessary qualifications and expertise of team members and assemble team
	▶ Establish the organisation safety policy
	▶ <b>Secure management commitment and financial support</b>
	▶ <b>Define roles and responsibilities of team members</b>
	▶ Appoint a team coordinator
	▶ Establish the context
<b>S.2.</b>	▶ <b>Identify and describe system components and interactions</b>
	- <b>Construct a system flow diagram</b>
	- <b>Describe the system and its subsystems</b>
	▶ Identify criteria and targets for products and services
<b>S.3.</b>	▶ Identify relevant hazards, risk sources and risk factors
	▶ Assess potential effect of climate change trends
	▶ Explore scenarios and potential events
<b>S.4.</b>	▶ Assess the likelihood and consequences for each event
	▶ Estimate the level of risk for each event
	▶ Evaluate the risk for each event
<b>S.5.</b>	▶ Identify risk reduction measures
	▶ Assess alternatives, prioritize and select risk reduction measures
	▶ Assess residual risk
	▶ Develop a risk treatment programme



# 4 | WCSP framework overview



Step	Key actions
	<ul style="list-style-type: none"> <li>▶ Establish or review operational monitoring procedures</li> </ul>
S.6.	<ul style="list-style-type: none"> <li>▶ Set critical limits</li> <li>▶ Develop corrective actions programme</li> </ul>
S.7.	<ul style="list-style-type: none"> <li>▶ Identification and characterisation of emergency situations</li> <li>▶ Develop an emergency response plan</li> </ul>
S.8.	<ul style="list-style-type: none"> <li>▶ Develop and implement communication programmes and protocols</li> <li>▶ Develop and implement management programmes and protocols</li> <li>▶ Review management and communication programmes and protocols</li> <li>▶ Record the risk management process at system level</li> </ul>
S.9.	<ul style="list-style-type: none"> <li>▶ Identify and develop supporting programmes needed for the implementation of the SSP</li> <li>▶ Review supporting programmes</li> </ul>
S.10.	<ul style="list-style-type: none"> <li>▶ Define tasks and responsibilities</li> <li>▶ Keep the SSP up to date</li> <li>▶ Record and report results</li> </ul>



# 5 | Advantages of adopting the WCSP framework

## Main advantages and benefits

- WCSP framework widens the scope to the entire urban water cycle incorporating additional primary safety aims
- adopting the ISO 31 000:2009 reference allows water utilities to use similar approaches for different risks
- WCSP approach has been carried out to enable application in a broader context not only climate change
- preventive and systematic risk approach supports decisions on adaptive measures and strategies for the whole UWC based on the best available knowledge



AGUA VAE | — LISBOA — 1814

Casaco e calções cinzentos. Lenço ás listas vermelhas, saindo da aljibeira. Chapeu de sol, vermelho.

(«Costume of Portugal» — H. L'Evêque)





# 5 | Advantages of adopting the WCSP framework

## Main advantages and benefits

- implementation of the WCSP in two levels of action (integrated level and system level) allows integration of:
  - different and sometimes conflicting interests and responsibilities
  - multiple objectives, points of view and perceptions of risk
  - comprehensive view of the adaptations needed to reduce the risks that affect the various components of the urban water cycle
  - detailed work from system level into the water cycle level
- promotion of collaborative processes involving various stakeholders acting in the water cycle
- effective communication and sharing of information among stakeholders
- decision making processes can be better supported and resources used more efficiently



## 6 | Lessons from demonstrations

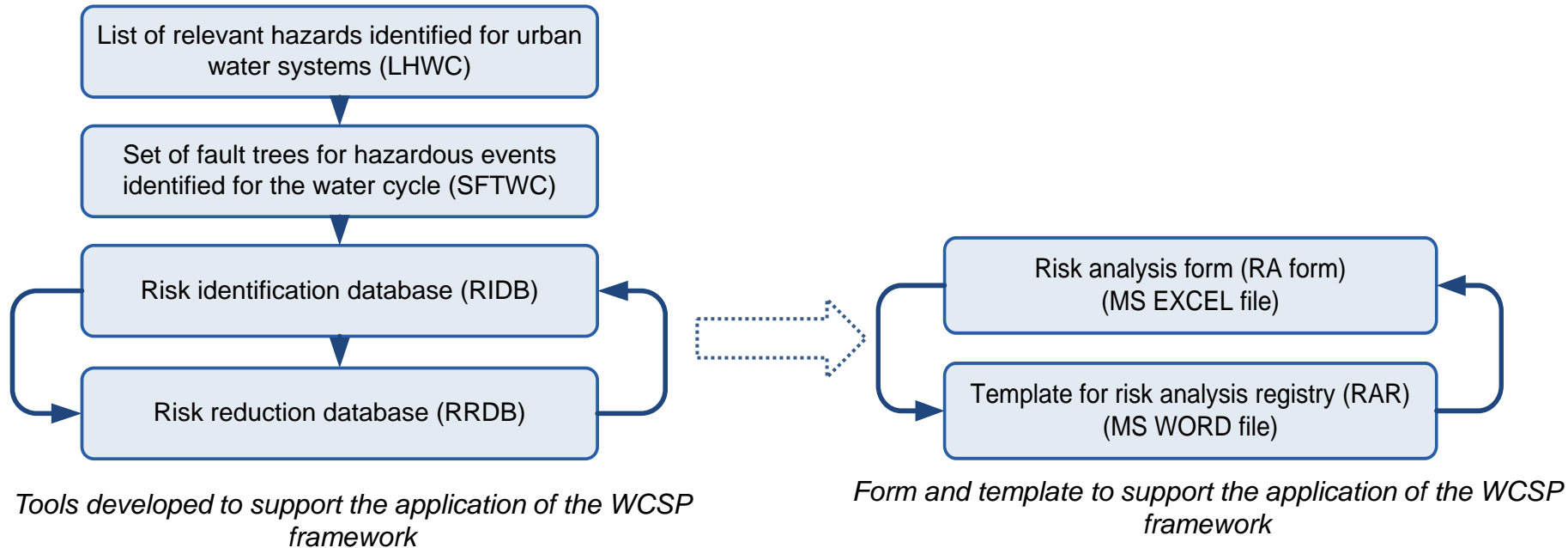


- WCSP represents an opportunity for improvement of the risk management area of the water utilities but it can also be beneficial for other areas e.g.
  - operation and maintenance
  - infrastructure asset management
  - occupational health and safety
- Implementing risk management processes is not a trivial task
  - concepts, terminology and methods are very specific
  - to be effective it needs to be a continuous improvement process
  - data availability is often a limiting factor
  - guidance to non-experts is essential to success



# 6 | Lessons from demonstrations

- PREPARED set of procedures and tools facilitate application of the WCSP





## 6 | Lessons from demonstrations

- The WCSP provides a framework
  - to **support decision** based on priority **estimated risks**
  - to **bring ongoing activities** by the stakeholders to an **integrated level**
  - to develop system safety plans in **coordination by different utilities** while maintaining important stakeholders **aligned**
- The WCSP allows for
  - **flexible** implementation, **adaptable** to different organizations and proceeding with available information and resources
  - if certain **risk aspects** have already been dealt with in detail, they can be **incorporated** without the need to go over the same work again
  - identification of specific needs for collecting data, the involvement of new stakeholders and the review when new requirements are put forward



## 6 | Lessons from demonstrations

- The WCSP allows for (cont.)
  - important added value in bringing people holding knowledge together so they can **identify weak spots** or missed issues, evaluate risk and risk reduction measures using **compatible** decision criteria
  - the systematic WCSP approach and the provided tools stimulate a **complete assessment of risks**
  - discussions on likelihood and consequences form the basis for a more **balanced** evaluation of risks and help building risk management programs
  - the **challenge** in many project based organizations will be to maintain the integrated level of risk management ongoing after a first WCSP cycle has been complete
- Communication is a key element to all aspects of the WCSP process
- **The WCSP is not a goal in itself. The goal is to have smart decisions in the design and management of urban water systems**



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