



# Proceedings International Conferences held



# COLOPHON

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# 1 Summary

PREPARED, Enabling Change is an EU-funded Collaborative Project under the Seventh Framework Programme (FP7). The project aims to gather urban utilities in Europe and worldwide to develop an advanced strategy in meeting the upcoming challenges for water supply and sanitation, brought on by climate change.

PREPARED works with 14 urban utilities in Europe, the USA and Australia to develop advanced strategies to meet anticipated climate change induced challenges in the water supply and sanitation sectors. The project will provide a framework that links comprehensive research with development programmes in these utilities. The technological and managerial response opportunities in the project are intended to be developed in the context of environmental, social and economic perspectives. The experience gained by the utilities will be shared with other actors of the water sector in Europe.

Work Area 7 of the project is responsible for dissemination of public access information through a number of specified activities (project website management; publicising the six-monthly newsletters; liaising with the city or utility communications departments to encourage local and national media coverage; supporting the organisation of PREPARED-focused conferences; editing a six-book publications series that focus on the components of climate change adaptation measures and strategies as outlined in the project deliverables; setting up regional networking platforms for information exchanges between PREPARED utilities and other utilities; developing a PREPARED brand for application to all cities that meet the criteria of being a 'PREPARED city'; and establishing a panel of climate change adaptation experts from staff in the participating cities, utilities, research organisations and SMEs.

This Conference Report reflects the deliberations of the PREPARED sessions during the PREPARED Conference: Adaptive solutions for water utilities that took place in Aarhus, in January 2014.

This conference was a three day technical event for water utilities, city authorities, researchers and consultants with an interest in how water utilities are working with practical solutions in order to adapt to climate change on a short, middle and long term time scale. The PREPARED partners and invited speakers presented their latest research and experiences. The conference tracks focused on solutions for operation and planning of wastewater and drinking water systems, Water Cycle Safety Plans, handling of Climate Change Scenarios and other key areas within PREPARED.

The third day of the conference consisted of the Utility Alliance Forum where water utilities shared their experience in solution specific sessions, evaluating the solutions applied in utilities within and outside PREPARED.

Throughout the 3 days, solutions were presented on posters and videos and the teams – utilities, research partners and technology providers – were available for in depth discussions.

## **SESSION THEME: WASTEWATER AND RECEIVING WATERS**

The main issue for the participating utilities related to climate change is a forecasted increased frequency of strong rain events and the possibility of flooding and combined sewer overflows. Tools and strategies to cope with this issue were presented during the PREPARED conference's session on "waste water and receiving waters":

The focus of this session was naturally on presenting the outcomes of PREPARED by the hosting institutions Aarhus Vand and DHI, who have achieved the implementation of a real-time monitoring, modelling and control system in the city's drainage system. This was supplemented by different solutions from other partner cities. These solutions ranged from high resolution rainfall measurements by radar (demonstrated in Lyon and Aarhus) to alternative treatment options during high flows (demonstrated in Oslo) and real-time-control systems (demonstrated also in Oslo), planning instruments (demonstrated in Berlin) and early warning systems (demonstrated in Lisbon) for protection of receiving waters.

In addition, tools were presented that enable utilities to model complex CSO structures including micro-location of sensors (SINTEF), data assimilation techniques for improving the accuracy of model predictions (Uni Exeter) and a software tool for sensor calibration, off-line data validation and uncertainty assessment (INSA Lyon).

The discussions showed that the utilities need to collaborate closely with authorities on this topic for successful implementation and long term utilization.

## **SESSION THEME: DRINKING WATER AND RESOURCES**

The topic of drinking water and drinking water resources is an issue especially in those regions of Europe in which water scarcity is expected to increase in the future (e.g. southern Europe). PREPARED set out to develop robust solutions and strategies to manage drinking water resources and optimize water treatment to cope with changing environmental conditions.

The solutions presented included a DSS for optimizing energy efficiency and supply security of water supply from different sources in Genoa, systems for rain-water harvesting and grey-water re-use in Istanbul as well as models for prediction of microbial re-growth (KWR) and treatment options for reducing bio-film formation potential at increasing temperatures (Oslo). In addition, the researchers within PREPARED had developed a catalogue of expected climate change effects and options for coping with these during water treatment or on the networks level (SINTEF). KWR presented technologies for storing freshwater in the subsurface to cope with strong variations in water supply.

Finally different tools for managing water resources from different sources were presented and discussed. In Berlin, for example, rising sulfate concentrations might lead to restrictions in terms of capacity and a decision tree was presented that will enable the utility to prioritize activities and offers possible solutions.

## **SESSION THEME: WATER CYCLE SAFETY PLANS**

A major outcome of the project PREPARED was the first practical implementation of the water cycle safety plan (WCSP) approach, integrating water supply, waste-water and environmental urban water issues. Different tools were developed to support utilities, authorities and stakeholders in setting up a WCSP and these were presented in this session:

- A database of hazards and risk reduction measures (LNEC),
- A methodology for quantitative risk assessment for climate change (Uni Exeter),
- Examples for using GIS to manage climate change (Iren Acqua Gas)

Within PREPARED the WCSP was practically implemented in the Netherlands (Eindhoven) and Portugal (Lisbon). These examples showed that the main benefit of this approach is the necessary close collaboration between the involved parties. The discussion on future challenges and possibilities covered the following points:

- The development of the WCSP approach is ongoing and should be further developed,
- It is recommended to improve & expand risk based aspects,
- Previous work (e.g. on WSP) should be incorporated,
- A bigger range of applications would be useful (small companies/utilities to large),
- Energy aspects should also be included, as well as social factors and resilience,
- Finally, changes in risk implementation should be taken into account.

## **SESSION THEME: ADAPTATION AND CLIMATE CHANGE SCENARIOS**

Although conventional urban water systems have served societies well, the fundamental concept is becoming compromised by climatic and urban changes. Urban water systems (i.e. water supply and sanitation) facilities are vulnerable to changing climate patterns (variation in rainfall, dry and wet spells, etc.); water systems are becoming more complex, uncertain and unpredictable. Today, there is a need to develop the manner in which urban water systems are informed. The need to transition away current and past experiences and to more adaptable and sustainable water systems are needed. This requires a deeper understanding of the interaction between climate change and water system, which can help identify new tools and methodologies to support engineers, planners, strategists, researchers, scientists, etc. in the design and management of the increasingly complex system.

Within PREPARED, initiatives (through collaboration) were taken to increase the technological capacity and performance of traditional urban water systems, demonstrating the efforts to turn to more adaptable designs. Looking to possible climate change scenarios, PREPARED is able to development of a portfolio of validated and demonstrated adaptive measures – in, for example, areas with water scarcity and water quality changes due to high temperatures – to help utilities plan for more resilient water systems in the context of climate change.

## **UTILITY ALLIANCE FORUM**

PREPARED used the final conference to host the PREPARED Utility Alliance Forum. The cities and water/wastewater utilities in Europe that participate in the project focus on climate change adaptation measures and strategies and their deliverables are constructed around their specific climate change adaptation needs. The R&D partners were tasked with developing innovative

solutions for the challenges posed by climate change under differing conditions. Innovations were demonstrated by the participating cities (Barcelona, Berlin, Eindhoven, Genoa, Istanbul, Gliwice, Lisbon, Lyon, Oslo, Simferopol and Århus). The different cities/utilities are currently in different phases of progress and they presented their results during the conference.

It is a stated goal of the PREPARED project to build a strong network of enthusiastic water utilities that would interact and share experiences on practical climate change adaptation issues such as flood protection, management of raw water sources, etc. The intention is that the Alliance Forum will exist beyond the life of the PREPARED project and beyond the specific topics of the R&D project. IWA who see the importance to continue collaboration and dialogue indicated the possibility to host future Alliance Forum meetings at IWA or other technical conferences.

## 2 Programme overview and presentations

This section provides the programme overview of the PREPARED Conference with links to the various presentations given during the conference.

### DAY 1

Tuesday, 21st January 2014

08:00-09:00 Registration + coffee / tea / breakfast

#### 09:00-10:30 OPENING SESSION

**Chair:** Anders Lynggaard-Jensen, DHI

09:00-09:05 - [Opening and welcome](#)

*Lars Schrøder, Aarhus Water Ltd.*

09:05-09:40 - [Status and change of climate change scenarios. Has uncertainty decreased?](#)

*Paul Fleming, Seattle Public Utilities*

09:40-10:15 - [Adaptation and climate change scenarios](#)

*Simon Tait, University of Sheffield*

10:15-10:30 - [PREPARED - enabling change - an overview](#)

*Adriana Hulsmann, KWR and coordinator of PREPARED*

10:30-11:00 Coffee / tea

#### 11:00-12:30 WASTEWATER AND RECEIVING WATERS 1

**Chair:** Ragnar Storhaug, AquateamCOWI

11:00-11:30 - [Integrated control and warning for urban wastewater systems during rainfall events - the infrastructure of the Aarhus case](#)

*Lene Bassø, Aarhus Water Ltd.*

11:30-12:00 - [Real time monitoring, modelling and control of combined sewer systems](#)

*Henrik Frier, Aarhus Water Ltd.*

12:00-12:30 - [Real time control to increase hydraulic capacity of wastewater treatment plants during rainfall events](#)

*Anders Lynggaard-Jensen, DHI*

#### DRINKING WATER AND RESOURCES 1

**Chair:** Gesche Grützmacher, Kompetenzzentrum Wasser Berlin

- [Adaption of water supply systems to make them climate change proof](#)  
*Stian Bruaset, SINTEF*

- [Adapted operation of drinking water systems, both treatment and distribution](#)  
*Adriana Hulsmann, KWR*

- [ASR and other subsurface water technologies that can help to deal with climate change related water problems](#)  
*Gerard van den Berg, KWR*

12:30-13:30	Lunch	
13:30-15:00	<b>WASTEWATER AND RECEIVING WATERS 2</b> <b>Chair:</b> Jean-Luc Bertrand-Krajewski, INSA-Lyon	<b>DRINKING WATER AND RESOURCES 2</b> <b>Chair:</b> Stian Bruaset, SINTEF
13:30-14:00	- Integrated control of combined sewer system and wastewater treatment plants during rainfall events <i>Nikolaj Mølbye, Krüger A/S</i>	- Remedial actions to prevent adverse effects of re-growth in networks at higher temperatures <i>Susanne Grobe, IWW</i>
14:00-14:30	- Warning system for deteriorated water quality caused by combined sewer overflows <i>Arne Møller, DHI</i>	- System for early warning of deteriorating water quality in distribution networks <i>Mirjam Blokker, KWR</i>
14:30-15:00	- Improved rainfall monitoring using local area weather radar <i>Lisbeth Pedersen, DHI</i>	- Real-Time Modelling for Smart Water Networks <i>Zoran Kapelan, University of Exeter</i>
15:00-15:30	Coffee / tea	
15:30-17:00	<b>WASTEWATER AND RECEIVING WATERS 3</b> <b>Chair:</b> Wolfgang Rauch, University of Innsbruck	<b>DRINKING WATER AND RESOURCES 3</b> <b>Chair:</b> Mirjam Blokker, KWR
15:30-16:00	- CFD modelling of a complex combined sewer overflow structure including micro location of sensors <i>Stian Bruaset, SINTEF</i>	- Substance flow model for the partially closed water cycle in Berlin <i>Gesche Grützmacher, Kompetenzzentrum Wasser Berlin</i>
16:00-16:30	- Data assimilation techniques for improving the accuracy of model predictions <i>Chris Hutton, University of Exeter</i>	- Decision support system for the competing uses of source water including protection of water intakes <i>Claudio Arena, Iren Acqua Gas SpA</i>
16:30-17:00	- Evohé - An integrated software tool for sensor calibration, off-line data validation and uncertainty assessment <i>Jean-Luc Bertrand-Krajewski, INSA-Lyon</i>	- Assessment of rainwater harvesting and grey water management - A case study for Istanbul <i>Selda Murat Hocaoglu, Tubitak</i>
19:00-22:00	Conference Dinner	

**DAY 2****Wednesday, 22nd January 2014**

08:00-09:00 Registration + coffee / tea

**09:00-10:30 WASTEWATER AND RECEIVING WATERS 4****Chair:** Luís David, LNEC**WATER CYCLE SAFETY PLANS 1****Chair:** Adriana Hulsmann, KWR

09:00-09:30 - Enhanced real-time measuring and forecasting technologies for combined sewer systems

*Rafal Ulanczyk, IETU*

- Water Cycle Safety Planning (WCSP) - general outline of the concept

*Maria Adriana Cardoso, LNEC*

09:30-10:00 - Sonar technique for sewer sediment monitoring

*Jean-Luc Bertrand-Krajewski, INSA-Lyon*

- Water Cycle Safety Planning in Portugal

*Ana Margarida Luis, EPAL*

10:00-10:30 - Real time control strategies for a biological chemical wastewater treatment plant - Demonstrations in Oslo

*Ragnar Storhaug, AquateamCOWI*

- Water Cycle Safety Planning in the Netherlands

*Frank van Swol, Municipality of Eindhoven*

10:30-11:00 Coffee / tea

**11:00-12:30 WASTEWATER AND RECEIVING WATERS 5****Chair:** Steen O. Petersen, Krüger A/S**WATER CYCLE SAFETY PLANS 2****Chair:** Simon Tait, University of Bradford

11:00-11:30 - Planning instrument for integrated CSO control in Berlin

*Pascale Rouault, Kompetenzzentrum Wasser Berlin*

- Hazard identification and risk reduction databases

*Maria Adriana Cardoso, LNEC*

11:30-12:00 - System for early warning of health risks from faecal contamination in recreational waters

*Luís David, LNEC*

- Quantitative Risk Assessment for climate change

*Janez Susnik, University of Exeter*

12:00-12:30 - Implementation of the methodology for climate change assessment for stormwater management in the Barcelona case study

*Xavier Aldea Borrueal, Cetaqua*

- Quantification of risk reduction measures

*Clemens Strehl, IWW*

12:30-13:30	Lunch	
13:30-15:00	<b>ADAPTATION AND CLIMATE CHANGE SCENARIOS 1</b> <b>Chair:</b> Gerard van den Berg, KWR	<b>WATER CYCLE SAFETY PLANS 3</b> <b>Chair:</b> Lydia Vamvakeridou, University of Exeter
13:30-14:15	<ul style="list-style-type: none"> <li>- <a href="#">DAnCE4Water - Concept for integrated modelling of the water cycle for the City development</a></li> <li>- <a href="#">DAnCE4Water – Life after Prepared</a></li> </ul> <i>Wolfgang Rauch, University of Innsbruck</i>	<ul style="list-style-type: none"> <li>- <a href="#">Use of GIS to manage climate change risks in Genoa and Simferopol</a></li> </ul> <i>Paola Latona, Iren Acqua Gas SpA</i>
14:15-15:00	<ul style="list-style-type: none"> <li>- <a href="#">DAnCE4Water - Application of integrated modelling of the water cycle for Melbourne</a></li> </ul> <i>Christian Urich, University of Monash</i>	<ul style="list-style-type: none"> <li>- <a href="#">Water Cycle Safety Planning and risk management: Discussion of the future possibilities</a></li> </ul> <i>Frank van Swol, Municipality of Eindhoven</i>
15:00-15:30	Coffee / tea	
15:30-17:00	<b>ADAPTATION AND CLIMATE CHANGE SCENARIOS 2 (INSTITUTIONAL ADAPTATION)</b> <b>Chair:</b> Paul Fleming, Seattle Public Utilities	
15:30-15:40	<ul style="list-style-type: none"> <li>- <a href="#">Introduction: Institutional Adaptation</a></li> </ul> <i>Liz Sharp, University of Sheffield</i>	
15:40-15:55	<ul style="list-style-type: none"> <li>- <a href="#">Framing Adaptation: Perspectives and meanings of adaptation in Wales</a></li> </ul> <i>Simon Tait, University of Sheffield</i>	
15:55-16:10	<ul style="list-style-type: none"> <li>- <a href="#">The Adaptation Planning Process</a></li> </ul> <i>Liz Sharp, University of Sheffield</i>	
16:10-16:30	<ul style="list-style-type: none"> <li>- <a href="#">Collaborative research: The opportunities and challenges of enabling change</a></li> </ul> <i>Emma Westling, University of Bradford</i>	
16:30-17:00	<ul style="list-style-type: none"> <li>- Discussion: Institutional Adaptation</li> </ul> <i>Simon Tait, University of Sheffield</i>	

**DAY 3****Thursday, 23rd January 2014**

**08:30-09:30** **Poster session and networking.** [Posters from the demonstration sites](#) and tools from technology providers are presented/discussed (coffee, tea etc. available during the session). The room will be open for all on all three days!

**09:30-11:30** **PREPARED Utility Alliance Forum**  
**SESSION 1:** Management of the urban water cycle under Climate Change conditions  
**Chair:** Gesche Grützmacher, KWB and Adriana Hulsmann, KWR

- [Making the most out of limited funds: which CSO control measures will bring maximum impact for surface water quality?](#)  
*Regina Gnirss, Berliner Wasser Betriebe*

- [Making the most out of limited resources: How Barcelona's water supply is getting prepared for future droughts](#)  
*Xavier Aldea Borrue, Cetaqua*

- [How to develop planning processes for utilities to achieve a more adaptive urban water system](#)  
*Simon Tait, University of Sheffield*

- [Wageningen keeps head above water in handling run-off](#)  
*Richard van Vliet, Municipality of Wageningen*

- [How to deal with monster rains in bigger cities](#)  
*Margit Lund Christensen, HOFOR*

**PREPARED Utility Alliance Forum**  
**SESSION 2:** Risk management in the urban water cycle  
**Chair:** Anders Lynggaard-Jensen, DHI and Gerard van den Berg, KWR

- [Developing and testing the DAnCE4Water planning tool for enhancing resilience together with Melbourne Water](#)  
*Christian Urich, University of Monash*

- [Experience gained from the use of water cycle safety planning](#)  
*Frank van Swol, Municipality of Eindhoven*

- [Lessons learnt from implementing adaptive solutions in Seattle](#)  
*Paul Fleming, Seattle Public Utilities*

- [Integrated real time control of sanitation systems](#)  
*Frode Hult, Oslo VAV*

- [Real-time monitoring and forecasting for early warning of faecal contamination in recreational waters: Pilot application in Lisbon](#)  
*Luis David, LNEC*

11:30-11:45 Coffee / tea

**11:45-13:00** **Closing session - Planning for the future**  
**Chair:** Gesche Grützmacher, KWB and Adriana Hulsmann, KWR

- [Visioning and planning for alternative urban water landscapes using future scenarios](#)  
*Chris Buscher, KWR*

- How PREPARED responds to societal challenges in Europe

*Riku Vahala, University of Aalto*

- What have we achieved and where do we go from there? - The future of the cities'  
Alliance Forum

*Gesche Grützmacher, KWB and Adriana Hulsmann, KWR*

13:00-14:00 Lunch To Go (in the foyer)

### 3 Conclusion

PREPARED Enabling Change is a utility driven project, in which priorities are set by cities, solutions developed in collaboration between utilities and cities which makes the project rather unique and effective in identifying adaptive solutions for water utilities in a time of unpredictable climatic variations.

PREPARED has demonstrated a number of tools – models as planning tools for real-time control for sewer networks as well as water supply systems, improved methodologies for system assessment, Water Cycle Safely planning, adaptive planning process – that can be applied to improve a cities capacity to adapt and mitigate the impact of climate change on its water supply and sanitation system.

The conference shed light on the fact that a number of challenges still exist:

- Adaptation to water resource scarcity/quality changes
- Adaptation to extreme rainfall events
- Integrated approaches to adaptation – Enabling change

Despite the challenges identified, the presentations provided by the speakers illustrated a number of successes that should continue to persist. Close collaboration between research, operation and authority was and remains important and necessary to continue to push forward. Researchers were aware of the operational constraints. Operators provided their experiences with researchers, and so forth.

In the end there are various approaches that can be taken, and these vary for cities. It is essential to identify what works for your city and work towards improving the capacity to adapt to climatic variations. Top-down models could work for Wales, while in Australia a more bottom-up approach would be ideal, where cities try to become the more “live-able” city.

The PREPARED Conference ended with a message of the importance continued collaboration and progress in identifying adaptive solutions for water utilities and the importance of continuous dialogue between partners and non-partners to enable that shift towards achieving adaptive water sensitive cities.

