

Workshop: Wet-weather modelling: Why and how should we tame the beast?

Wet-weather (WW) events and periods have a large impact on the Water Resource Recovery Facility (WRRF) behaviour and on its capability to comply with regulations. There has been a significant increase in interest in this topic in recent years. Publications like “*Guide for Municipal Wet Weather Strategies*” published this year by the Water Environment Federation (WEF) as well as “*Design and Operational Considerations for the Management of Wet Weather Flows at Water Resource Recovery Facilities*” (to be published in early 2014 by WEF as well), are meant to provide guidance to those involved in solving the unique challenges associated with the management of WW events. Both of these publications emphasize the importance dynamic modelling plays in providing adequate support in understanding WW phenomena and in evaluating design and operation options with regard to their performance during WW events.

The workshop will tackle the issue by promoting discussion around three main questions:

- Why is WW modelling important?
- What is happening in a WRRF during WW and how can we model it?
- How can we model measures that mitigate the effects of WW?

Expected discussions and results

In recent years municipal utilities have been facing the need to provide significant improvements on how they manage WW-related flows in their WRRFs as the result of increased regulatory and public pressures. These flows and loads, which result from combined sewer systems or even separate systems that have significant amounts of infiltration and inflow, can in many cases exceed the treatment capacity of existing facilities. However, the overall approach necessary to identify, evaluate, and eventually select the “best” WW flow management scenario for a particular WRRF in terms of process units and operational requirements is one that contrasts significantly from that normally used by the same utilities in dealing with dry weather (DW) treatment needs.

It can be argued that one of the most appropriate fields of application of dynamic WRRF modelling is indeed the study of WW events and periods, given the extremely time-varying nature of such phenomena, with typical time scales ranging from minutes to days. The behaviour of the facility in WW is very different from DW, especially with regard to influent flows and loads, primary and secondary settling efficiency, mixing, biological treatment performance, oxygen transfer and solids inventory transfer between the biological reactors and secondary settling tanks. This requires additional modelling efforts compared to DW, to enable decision support regarding design and operation alternatives devised to achieve permit compliance of the facility.

The topics covered by the workshop comprise an introduction to regulatory requirements and benefits of WW dynamic modelling, an overview of the main phenomena occurring at WRRFs during WW and of modelling of selected design and operation WW strategies. The presenters are based in both Europe and North America, and from both academia and consultancy. Plenary open discussion (60% of the total time) is allocated after each of the three presentation blocks and at the

end of the workshop, with the participation of a panel of invited experts. “On the fly” model runs will be performed during the discussion periods to interactively illustrate/test specific aspects.

A summary of the presentations and of the discussion will be shared with the WWTmod group.

Expected outcomes:

- dissemination of current status in WW management and its modelling, with focus on implications for WRRF design and operation, leading the way to a deeper understanding of the aspects affecting the WRRF’s performance under WW;
- identification of main challenges, gaps and opportunities, both for model development and application;
- a white paper on the state of the art and challenges related to WW modelling, with contributions by the presenters and by interested workshop participants.

Workshop set-up

The workshop is organized as follows:

- one presentation provides an introduction to regulatory requirements related to WW, and a summary of dynamic WW modelling benefits; discussion follows
- two presentations illustrate the modelling (limitations) of the phenomena associated to WW, causing the facility’s disturbance by WW (influent flows and loads) and occurring at the plant (mixing, settling, oxygen transfer, etc.); discussion follows
- two presentations introduce design and operation options aimed at dealing with WW, and in particular their specific modelling (limitations) issues; discussion follows
- a last discussion period is dedicated to more clearly identifying and finding consensus on the current status, directions, opportunities and gaps in WW knowledge and modelling.

Chair/Co-chair

Lorenzo Benedetti (Waterways, Italy)

Peter Vanrolleghem (Université Laval, Canada)

Speakers / Moderators

Lorenzo Benedetti (Waterways, Italy)

Charles Bott (Chief of Research and Development, HRSD, USA)

Jose Jimenez (Brown & Caldwell, USA)

Dave Kinnear (HDR, USA)

Paul Krauth (Utah Division of Water Quality, USA)

Cristina Martin Andonegui (DEUSTOTECH, Spain)

Julian Sandino (CH2M HILL, USA)

Oliver Schraa (Hydromantis, Canada)

Peter Vanrolleghem (Université Laval, Canada)

Stefan Weijers (Waterschap De Dommel, Netherlands)

Invited panel (confirmed)

Gerda Hald (Director, Planning & Investments, VandCenter Syd, Denmark)

Jeroen Langeveld (RHDHV / Delft University, Netherlands)

Target Participants

- Utilities/operators: stimulate ideas on how to improve the performance of their systems.
- Consultants: find and show ways to better serve their clients.
- Academics: opportunity to show current activities and to identify research needs expressed by utilities and consultants.

Programme

Time	Topic	Speaker/Moderator
09:45 - 09:55	Introduction: Motivation, scope, and objectives. Present workshop structure, participants, etc.	Lorenzo Benedetti
09:55 - 10:15	Presentation #1: <i>“Why do we have to tame the beast?”</i> Regulatory, design and operational aspects of WW; support provided by modelling in design and operation.	Julian Sandino Stefan Weijers
10:15 - 10:45	Discussion Period: regulation	Paul Krauth
10:45 - 11:15	Coffee break	
11:15 - 11:35	Presentation #2: <i>“What is making the beast angry?”</i> Modelling WW influent aspects: flows, loads, and variability.	Cristina Martin Andonegui
10:35 - 11:55	Presentation #3: <i>“What are the aspects of the beast’s anger?”</i> Modelling WW impact on plant behaviour: mixing, settling, aeration, etc.	Peter Vanrolleghem
11:55 - 12:45	Discussion Period: modelling	Dave Kinnear
12:45 - 13:45	Lunch break	
13:45 - 14:05	Presentation #4: <i>“How do we tame the beast? The hard way.”</i> Modelling design options for WW mitigation.	Jose Jimenez
14:05 - 14:25	Presentation #5: <i>“How do we tame the beast? The soft way.”</i> Modelling control options for WW mitigation.	Oliver Schraa
14:25 - 15:15	Discussion Period: mitigation	Charles Bott
15:15 - 15:45	Coffee break	
15:45 - 16:45	Discussion Period: general and conclusions <ul style="list-style-type: none"> • Summary • State-of-the-art • Future • Next steps 	Julian Sandino
16:45 - 17:15	Wrap-up, composing summary, report and presentation	