Modelling Wastewater Treatment Plants

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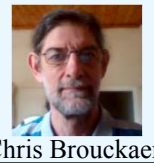

Chris Brouckaert

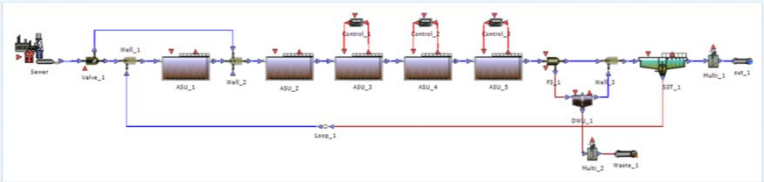

Akash Singh

ETHEKWINI MUNICIPALITY

Introduction

Municipal wastewater treatment plants (WWTPs) have traditionally been designed very conservatively, to accept the wide variations in flow and water quality without much adjustment to their operation. This approach becomes increasingly expensive in terms of capital and running costs as environmental limits on the treated effluent quality become more stringent. Furthermore, eThekwini Water and Sanitation (EWS) experiences considerable difficulties at some of its WWTPs due to significant loads of industrial effluents.

Simulation models are tools which can assist in designing more efficient new plants, and in making existing plants more efficient and more responsive to varying loads. The Pollution Research Group is assisting EWS to develop WWTP modelling expertise by providing training and undertaking research projects.

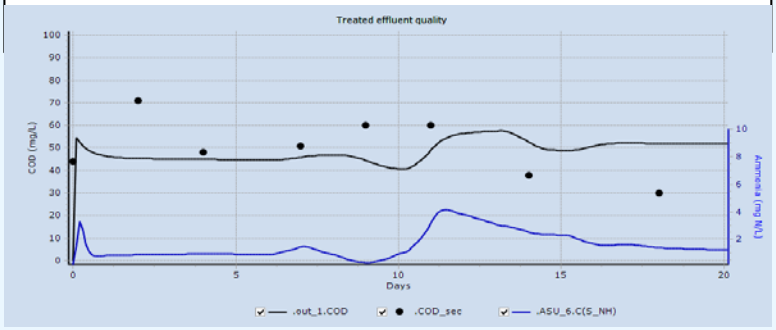


Modelling Course

A series of six training sessions were conducted for personnel from EWS and Umgeni Water between May and August 2014. The theme of the course was to develop, calibrate use a model of a WWTP, with the aim was to have a documented working model of an actual plant by the end of the course.

A section of the Northern WWTP was chosen as the case study, and 4 of the 6 sessions were conducted at the Training Centre located at the plant. The sessions took place at approximately 2 week intervals, to allow the participants to obtain data or resolve issues identified during the sessions.

Since then, a number of modelling projects have been started by EWS engineers.



Verulam WWTP (Farai Mhlanga)

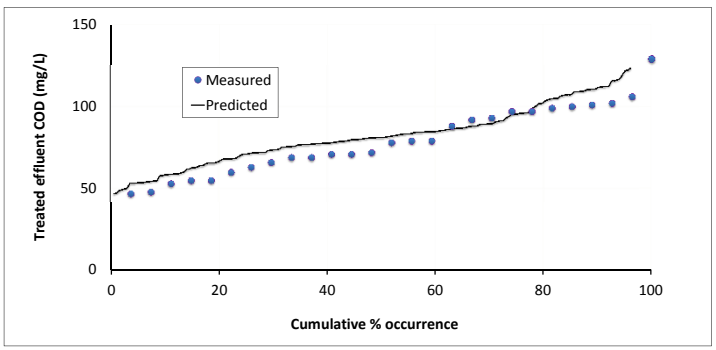
The Verulam WWTP was the subject of a project funded by the Water Research Commission (WRC) to investigate the impact of textile factory effluents on WWTPs.

There are 6 major factories discharging industrial wastewater to Verulam WWTP.

Company Name	Core business
JMV Textiles	Weaving and finishing textiles
Colgate Palmolive	Soap, tooth paste manufacturers
Budget Soap	Soap and detergent manufacturer
Packo	Food products
Nampak Tissue	Hygiene services- tissue paper production
Frimax Foods	Food products, chips

The significant any highly variable contribution of industrial effluents made characterising the wastewater stream very difficult using sampling and chemical analysis. To overcome this, a model of the wastewater generation in the catchment was constructed. This considers contributions from domestic sewage, the 6 major industrial sources and storm water infiltration.

Statistical comparison of catchment/WWTP model with measurements

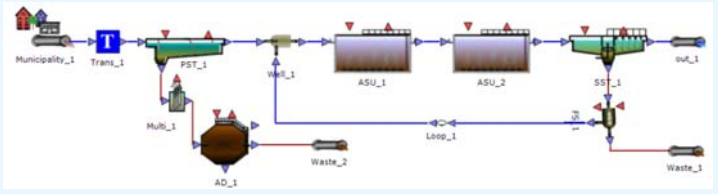


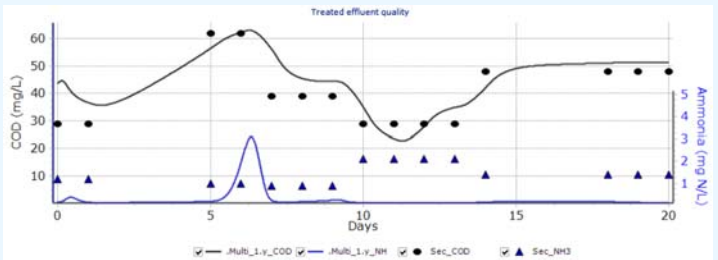
Phoenix WWTP (Akash Singh)

The Phoenix WWTP model is being developed as part of a WRC sponsored project to evaluate modelling as a means of assessing whether a WWTP is performing as it should, given the effluent it receives. A secondary objective to validate a new plantwide model (i.e. including both aerobic and anaerobic processes) on full-scale WWTP data. The model (PWM_SA) is being developed at the Universities of Cape Town and kwaZulu-Natal.

Experience so far suggests that characterization of the influent wastewater is the most taxing part of developing a model for a specific WWTP. The measurements routinely made as part of monitoring the operation are generally insufficient for modelling purposes, and frequently contain errors and inconsistencies. Although the catchment balance method used for Verulam was successful, it was very time-consuming. One of the objectives of the investigation is to determine how much can be achieved with available routine measurements, and the minimum additional measurements required for a successful model. This includes methods to clean up data by identifying and eliminating inconsistencies.

In general, routine measurements at Phoenix appear to be sufficient to simulate the average the performance of the liquid treatment train.





Acknowledgements

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WATER RESEARCH COMMISSION
UNIVERSITY OF CAPE TOWN Water Research Group