TECHNICAL BRIEF

October 2016
The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

Determining the cumulative impacts of WWTW on a catchment

A completed Water Research Commission (WRC) study has developed a new tool to determine the cumulative impacts of point source discharge from low-volume, privately-owned treatment works on river health.

Background

The sustainable treatment of domestic wastewater is a global problem that threatens human and aquatic ecosystem health. Treated and untreated wastewater impacts on receiving aquatic ecosystems by altering the water quality and quantity characteristics within these environments.

While domestic wastewater treatment is generally undertaken by large, centralised works, there is a growing number of low-volume, privately-owned treatment works (LVPOTW). As a result of a general lack of information on these works, their cumulative impact on a catchment is rarely known.

This lack of information poses a problem for decision-makers and authorities regarding the number and size of LVPOTW that can sustainably be accommodated in a given catchment.

This scoping study was therefore undertaken to investigate the cumulative impacts of point source discharges from these small treatment works on river health, with eThekwini Metropolitan Municipality being selected as the study area.

New evaluation tool

The literature review revealed that it is extremely difficult to determine the cumulative impacts of LVPOTW on river health as available tools are:

- Too narrow in their scope (e.g. only examining water quality impacts)
- Too data-intensive to be reliable and/or practical in a South Africa (i.e. diverse and data deficient) context
- Do not take catchment-scale impacts and the type, state, importance and sensitivity of the receiving ecosystems into account.

These shortcomings limit policy- and decision-makers regarding the number of LVPOTW that a catchment can have.

For these reasons, a new tool was required for this study that:

- Incorporated international best practice
- Considered both water quality and water quantity impacts
- Considered catchment-scale processes and
- Considered the type, importance and sensitivity of the receiving systems.

Therefore, a new tool was developed as a Bayesian Network as these networks a) were seen as the most appropriate method to incorporate the above-mentioned criteria and b) are based on a robust statistical foundation.

The result of comparing modelling and field-based assessment were positive: with the model able to accurately determine the probable cumulative impacts of the LVPOTW on river health in the catchments. These assessments allowed for a more coherent understanding of the impacts of these small treatment works on river health, and the natural assimilative capacity of rivers receiving treated effluents from these plants.

Moreover, the Bayesian Network provided valuable information not attainable through conventional assessment methods.

In the Nkutu River, the network predicted that the river health downstream of the LVPOTW's discharge point had a 53.4% chance of being in a 'low' risk category, but also that

there was a relatively high chance (40.3%) that the system would be in a 'zero' risk condition. The result is supported by a decade's worth of biomonitoring data on the system.

Thus, it is concluded that Bayesian Networks prove useful tools to provide preliminary guidance on management for small treatment plants within a catchment. Given the result of this study, these networks could provide decision-makers and authorities with an incredibly powerful and relatively low-cost tool to predict impacts of proposed LVPOTWs on river health.

Figure 1 provides a hypothetical stylistic example of the cumulative impacts of LVPOTWs on river health.

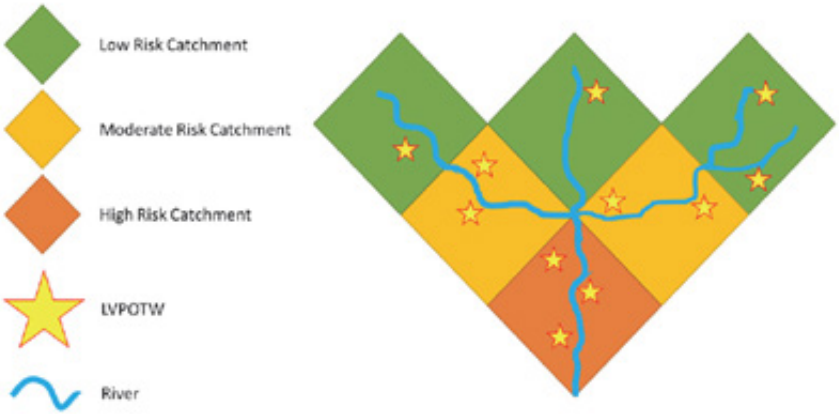

Figure – Hypothetical stylistic diagram indicating increasing risk to river health as a result of cumulative impacts from LVOPTW in catchments.

Further reading:

To obtain the report, ***Scoping investigation into the cumulative impacts of point source discharge from low-volume privately-owned treatment works on river health in the eThekwini Municipality*** (**WRC Report No: KV 355/16**) contact Publications at Tel: (012) 761-9300 or Visit: www.wrc.org.za to download a free copy.