POLICY BRIEF

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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.

Palmiet River – Integrated catchment risk assessment

A completed Water Research Commission (WRC) research project successfully developed a generic risk assessment framework of river pollution in the Overberg West sub-catchment of the Breede-Gouritz water management area. The purpose of the framework is to integrate data and information, resulting out of the integrated risk assessment, into the decision-making structures of the Breede-Gouritz Catchment Management Agency and other relevant authorities. It is envisaged that the outcome of this research will be used to aid the regulatory function of water resource quality and reporting.

Background

The Palmiet River.

The management of the combined effect of urbanisation, industrialisation and population growth on water resources is a challenging task, and the increasing demands for water for different uses require a broad range of water management strategies and tools.

It is acknowledged that there are serious water-quality impacts and threats to particularly downstream water users and human health in the Breede-Gouritz water management area (BGWMA). This could possibly be attributed to an increase in anthropogenic activities.

Therefore, an integrated approach is needed to obtain the knowledge on the involved anthropogenic, hydrological and biochemical processes within this sub-catchment in order to manage any effects. This research focused on developing a generic risk assessment framework of river pollution in the Overberg West sub-catchment of the BGWMA.

The framework covers pollutant sources, identification and types, pollutant transport modelling, hazard estimation, exposure assessment, risk mapping and risk management.

Methodology

The research was conducted in the Palmiet River and its tributaries (Klipdrift and Swannies rivers) which pass through the urban area of Grabouw in the Overberg West sub-catchment of the BGWMA. This site was selected because industrial, agricultural and domestic wastewater and runoff resulted in elevated organic loads in the rivers downstream, causing eutrophication and low dissolved oxygen levels.

Primary data was generated by collecting and analysing water and sediment at various sections on the Swannies, Klipdrift and Palmiet rivers to measure the biological, chemical and physical quality of the water. The results of the samples were verified against a revised mathematical transport model.

Secondary data was obtained from sampling records and water quality analysis reports of the BGCMA.

Results and discussion

The most pronounced hazards found in Grabouw are linked to agriculture, abattoirs, manufacturing, and the motor industry. Rivers frequently receive contaminated wastewater and particulate waste either directly or indirectly from urban, industrial or agricultural activities.

Specific pollutants (related to anthropogenic activities

surrounding the Palmiet River and tributaries) were identified and their toxicity, significance and effect are described in the final report to the study. The research found that these all posed a threat to the human health and the environment.

The medium and compartments relevant to modelling the exposure, fate and transport of pollutants in the Palmiet sub-catchment of Grabouw are as follows:

1. The pollutants from anthropogenic activities is released to surface water
2. Through sorptions embedded into the sediment or
3. Released directly onto the surface soil.

The pollutants are transported either via the stormwater system into the wastewater treatment system and then into the river system; or via the stormwater system into a wetland and then into the river system; or via the stormwater system into the river system; or directly into the river system.

Laboratory analysis reveal that pollutant concentration levels for especially certain pesticides and trace elements enters the river system at high levels. The concentration levels were used as input into a practical statistical model risk assessment to predict direction and spread for a distance of about 7 km – the distance of urban and industrial influence. Beyond this distance agricultural areas become more apparent.

The application of the practical model for fate and transport revealed that the pollutant concentrations have a tendency to initially decrease and then increase to that same level. The application of a mathematical model indicates that the trends in concentrations at various distances, up to 35 m, 40 m, 6 500 m, and 7 000 m downstream, tend to increase and become diluted as the tributaries join the main river and as the flow over dense vegetation which acts as filters. The concentration then decreases but only to approximately the same levels at which it entered the system.

This means that as tributaries with similar pollutants enter the Palmiet River, pollutant loads increase. However, further downstream dilution and filtration start to take effect, leading to a decrease in pollutant load.

Conclusions

Conceptual models (to display environmental pathways) are ideal tools to link and show relationships between the emission of the pollutant and the receiving water bodies. The application of an integrated risk assessment required the use of predictive models.

Once the pollutant enters the water body, an effective mathematical model is then needed to predict the pollutant concentration levels and how it is distributed and spread over various distances. The model used in this research tends to be useful in small river systems, however, this model will need to be expanded to predict how pollutants are transported over larger distances.

Recommendations

The following recommendations emanated for decision-makers from this study:

- That local authorities be required to include a risk assessment strategy for water resources in their compulsory environmental management plans.
- Instead of just routine monitoring, local authorities and CMAs need to develop surveillance systems to establish exposure risk relations and estimate impact.
- That the Resource Water Quality Objectives be set for anthropogenic specific parameters. In other words, authorities need to submit a list of all anthropogenic activities and associated pollutants within a specific geographical radius of a water resource.

To order the report, ***Combined effect of urbanization, industrialization and population growth on water quality of the Palmiet River and its tributaries in the Overberg West sub catchment of the Breede-Gouritz water management area: An integrated catchment risk assessment*** (**K5/2329**), contact Publications at Tel: (012) 761-9300, Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.