

Sustainable development indicators for urban water systems: A case study evaluation of King William's Town, South Africa, and the applied indicators

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Abstract

In the light of the increasing pressures on the world's freshwater resources, changes in the present and future urban water systems are called for in order to achieve sustainable development. The transformation from unsustainable practices demands tools that measure progress and can warn of future trends. Sustainable development indicators (SDIs) have been suggested as tools for a number of fields, including the urban water sector. This case study applied 20 SDIs to an urban water system in King William's Town, a medium-sized city in the semi-arid, mostly underdeveloped Eastern Cape of South Africa. The main aims were twofold: To evaluate the sustainability of the urban water system, and to evaluate the individual factors according to criteria. A final working list of the 15 SDIs was found useful for the study area and was produced for use also in future studies.

Introduction

The increasing use of the world's freshwater resources, coupled with the acknowledged environmental deterioration and exhaustive use of limited resources and energy in a modern urbanised society, calls for changes in present and future urban water and wastewater systems. As a large part of the world's population still lacks access to safe drinking water and adequate sanitation, and as global urbanisation continues to increase, an expansion of these systems is necessary. For these reasons, it is important that policy-makers, engineers and the general public have proper information so that the current situation can be evaluated, trends identified, and ways can be found to a more sustainable future. Sustainable development indicators (SDIs) have been proposed in numerous fields as powerful tools for this work, and the urban water sector is no exception. Lundin et al. (1997) have compiled a number of proposed SDIs for this sector, and also evaluated them in a case study (Lundin et al., 1999) on Sweden's second largest city. This was in an urban environment of a developed country with little stress on its freshwater resources. A larger problem is facing developing countries with moderate or much stress on their freshwater resources, and therefore demands an additional study into the use of indicators in such areas. The aim of this study was to evaluate the use of 20 SDIs in urban water systems of King William's Town, South Africa.

The urban water system of King William's Town is currently not moving towards sustainability. Freshwater withdrawal from the Maden and Rooikrans Dams has passed acceptable levels and the future plan of inter-basin transfer is not believed to guarantee this resource beyond 2005. The treatment performance of the Schornville Sewage Treatment Works is poor and the removal percentage of phosphorus is decreasing. Coupled with increasing concentrations of P, N, and COD in the raw wastewater, the Buffalo River, already threatened by eutrophication and salinisation, is now receiving increased nutrient loads and oxygen demand. Certain

aspects have been improving though. The water consumption per capita per day has stabilised around 230 l/cap-d and is well above the WHO minimum levels.

Introduction to indicators

An urban society needs a number of infrastructural installations to function properly. The provision of safe drinking water and the removal and treatment of wastewater and storm water are prerequisites for a healthy population and the functioning city and urban water systems (UWSs) were initially designed in order to meet these objectives. More recently, global awareness and recognition of society's negative influence on the environment have grown and call for additional purposes and goals of an urban environment's subsystems, including its UWS. In addition to the original objectives, which mainly concerned human health, a modern water and wastewater system must consider energy efficiency, resource use, environmental effects, access to service, service quality and other aspects of sustainable development. The objectives of developing a UWS are to:

- preserve the quality of the raw water resource
- allow for sustainable use of the raw water sources
- supply the general population with safe drinking water in sufficient quantity
- supply the general population with adequate sanitation and
- reduce the use of limited resources and energy to within the levels of sustainability.

Indicators, in general, are pieces of information, which have a wider significance than their immediate meaning (Bakkes et al., 1994). An indicator is useful if it is of fundamental interest in decision-making, simplifies or summarises important properties, visualises phenomena of interest and quantifies and communicates relevant information (Gallopini, 1997). In addition to its essential quantifying function, further relevant functions include assessing conditions and trends (sometimes in relation to goals and targets), providing information for spatial comparisons, providing early

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