

# The impact of inadequate wastewater treatment on the receiving water bodies – Case study: Buffalo City and Nkokonbe Municipalities of the Eastern Cape Province

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## Abstract

The performance of four wastewater treatment plants that serve the Buffalo City (Dimbaza, East London) and Nkokonbe (Alice, Fort Beaufort) Municipal areas in the Eastern Cape Province of South Africa was investigated for the removal of microbial and chemical contaminants. Statistical evidence showed a relationship between the quality of the final effluent and that of the receiving water body and the relationship was such that the better the quality of the final effluent, the better the quality of the receiving water body. The quality of both the effluents and the receiving water bodies was acceptable with respect to the temperature (mean range: 16.52 to 23.33°C), pH (mean range: 7.79 to 8.97), chemical oxygen demand (COD) (mean range: 7 to 20 mg/l) and total suspended solids (TSS) (mean range: 161.43 to 215.67 mg/l). However, in terms of the nutrients (orthophosphate - mean range: 3.70 to 11.58 mg/l and total nitrogen - mean range: 2.90 to 6.90 mg/l) the effluents and the receiving water bodies were eutrophic. The dissolved oxygen (DO) (mean range: 3.26 to 4.57 mg/l) and the biological oxygen demand (BOD) (mean range: 14 to 24 mg/l) did not comply with the EU guidelines for the protection of the aquatic ecosystems. The general microbiological quality of the effluents discharged from all the plants did not comply with the limits set by the South African authorities in respect of pathogens such as *Salmonella*, *Shigella*, *Vibrio cholera* and coliphages. The effluents discharged from the Dimbaza, East London, Alice and Fort Beaufort wastewater treatment plants were identified as pollution point sources into their respective receiving water bodies (Tembisa Dam, the Nahoon and Eastern Beach which are part of the Indian Ocean; the Tyume River and the Kat River).

**Keywords:** wastewater, treatment, effluent, receiving water bodies, pollution

## Introduction

South Africa is a water-scarce country, and the demands on this resource are growing as the economy expands and the population increases. For the country to continue to develop economically, while meeting the wide-ranging needs for water, urgent steps must be taken to protect the quality of the resource. It is well known that water sources are subjected to frequent dramatic changes in microbial and chemical qualities as a result of the variety of activities on the watershed. These changes are caused by discharges of municipal raw waters or treated effluent at a specific point-source into the receiving waters such as streams, rivers, lakes, ponds etc. (Gieldereich, 1990). Point-source pollution problems not only increase treatment costs considerably, but also introduce a wide range of potentially infectious agents to waters that may be supplied to many rural and urban communities, thus resulting in incidences of waterborne diseases with far reaching socio-economic implications (Craun, 1991).

Pathogens such as *Shigella*, *Salmonella*, *Vibrio cholera* and enteric viruses have been known to cause severe diarrhoea, in children and adults, which can lead to morbidity and mortality, as experienced in South Africa recently with outbreaks of *Shigella dysenteriae* and *Vibrio cholera* that resulted in 13 and 288 fatalities, respectively (Pegram et al., 1998; DPLG 2001). Also,

typhoid fever remains endemic to many parts of South Africa, including KwaZulu-Natal, Limpopo and the Transkei (Coovadia et al., 1992), with a recent outbreak occurring in Delmas, Mpumalanga. In this province, health spokespersons reported that there were 380 cases of diarrhoea, 30 suspected cases of typhoid fever and nine confirmed cases (*Mail and Guardian*, 2004). The outbreak originated in the town's water supply, suspected to have been contaminated with human faeces. Hepatitis A virus, caliciviruses, adenoviruses, rotavirus, and enteroviruses have the greatest effect on public health. A large number of epidemics due to the presence of these viruses in the environment have been reported (Anderson and Strenström, 1987; Yao, 1988; Bosch et al., 1991).

Wastewater treatment plants discharge significant amounts of faecal pollution indicators and pathogenic micro-organisms leading to a reduction in the quality of water (Bahlaoui et al., 1997; Simpson and Charles, 2000). The Buffalo City and Nkokonbe Municipalities of the Eastern Cape Province are obligated to provide safe drinking water, to address public health risks of polluted environmental water affecting the entire community, and to comply with stipulated standards. The poor operational state and inadequate maintenance of most of these municipalities' sewage treatment works, i.e. design weaknesses, overloaded capacity, faulty equipment and machinery, has resulted in major pollution problem and impacts on the quality of water resources, with marine water quality standards consequently not meeting regulatory standards. In this paper, we report the impacts of discharged effluents of some wastewater treatment plants located in the Eastern Cape Province of South Africa on their respective receiving water bodies.

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