

# Water quality guidelines for livestock watering in Southern Africa

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## Abstract

The validity of the water quality guidelines for livestock watering is questionable as these are based largely on international guidelines and lack locally established water quality constituent lists, levels of acceptability and reference to Southern African livestock production systems. The water quality constituents fluoride, chloride, total dissolved solids and sulphate were identified in a review of subterranean water samples from non-hydrogauging stations from the Northern Province, North-Western Province and the Northern Cape Province as being the primary constituents of concern for livestock watering. Biological trials investigating toxicological and palatability aspects regarding the constituents fluoride, chloride, total dissolved solids, sulphate, nitrate and nitrite were conducted in sheep, cattle and poultry. The results indicated that the guidelines in use were too conservative for specific categories of livestock within Southern African livestock production systems, and that the guideline format used was inadequate in assessing the effects of water quality over the diverse range of livestock production systems found in Southern Africa. For a more accurate assessment of the effects of water quality for a given livestock production system the format should be based on ingestion levels, as opposed to a mg/l basis, and should take into account site-specific synergistic and antagonistic interactions within and external to the water to a greater extent. The results led to the compilation of the interim water quality guidelines currently in use and to the formulation of a water quality guideline index system.

## Introduction

Water quality guideline levels and constituents considered to be relevant for livestock watering differ between countries (Adelaar, 1974; Ensminger et al., 1990; Hart et al., 1992; Kempster et al., 1985; Smith, 1988; South African Water Quality Guidelines, 1993 and USEPA, 1976). This reflects both environmental and livestock production system differences and indicates the need for each country to have its own site-specific levels and constituents. Research regarding these factors for Southern Africa is needed, mainly as the present levels and constituent selections are based largely on assumptions as yet untested in the Southern African context owing to a lack of locally established guidelines (Casey et al., 1994). Livestock watering guidelines published by Kempster et al., (1985) and Smith (1988) differ considerably from those recommended by Adelaar (1974), Marincowitz and Conradie (1985) and the Borehole Water Association of Southern Africa (1990). The latter guidelines are still in use by Namibia, the Department of Agricultural Development and the Directorate of Soil Protection and Borehole Services. The South African Water Quality Guidelines (1993) are a combination of the international and the less conservative local guidelines (Adelaar, 1974).

Verification of the validity of the guidelines in use is required in order to accurately estimate the fitness for use of a water source for livestock production. The effects of changes in water quality on livestock production can be divided into three categories, namely, livestock consumption, livestock watering systems and livestock product quality. Livestock consumption refers to water quality problems arising from the ingestion of constituents which adversely affect the health and/or production of the animal. Toxicological and palatability norms are used to measure livestock consumption effects. For livestock watering systems,

norms such as scaling, corrosion and encrustation are used. Livestock product quality involves product quality and consumer health hazard norms. Livestock consumption issues form the focus of this paper.

The most recent guidelines as published by the Department of Water Affairs and Forestry (1996), are the first to incorporate to some degree the problematic aspect of a water quality constituent having a wide range of effects at the same concentration depending on relevant site-specific factors. The format still has shortcomings, mainly as synergistic and antagonistic factors affecting tolerance levels, ingestion levels and subsequent production are not accounted for sufficiently. Although constituents are seldom mutually exclusive, interdependency between constituents is not catered for sufficiently. These guidelines are the first to provide information regarding possible mitigatory and treatment options, but due to the complex factors determining the suitability of a water source and the different livestock production systems that occur in Southern Africa, no solution for sources which exceed the recommended levels or ranges is given. While this may not necessarily be a guideline function, the scenario of inherently saline waters with high concentrations of potentially adverse constituents presents itself frequently in the arid zones and developing areas of Southern Africa. As a result most international guidelines, many of which have been incorporated into the 1996 guidelines, only serve to inform the user of the high risk associated with use without providing a management tool for utilising the water more optimally. In many of these cases livestock production continues, but the efficiency thereof is lowered. This has economic and environmental implications, such as increased cost of production and decreased feed utilisation, often adding to overgrazing problems, particularly in small-scale production systems.

This paper gives a brief summary of research results which led to the development of the guidelines published by the Department of Water Affairs and Forestry (1996), which are viewed as interim guidelines, and in conclusion describes the need for a water quality guideline index system in Southern Africa.

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