

# Operation and monitoring guidelines and the development of a screening tool for irrigating with coal mine water in Mpumalanga Province, South Africa

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## Abstract

It is predicted that vast volumes of impacted mine water will be produced by mining activities in the Mpumalanga coalfields of South Africa. Irrigation provides for a novel approach to the utilisation and disposal of mine water, under the correct conditions. The significance of these findings lies in the versatility of this irrigation. Communities which often have very few other resources can utilise mine water to generate livelihoods. Research over a period of more than 10 years has shown that this water can be used successfully for the irrigation of a range of crops. The potential environmental impact of this excess water is of great concern in a water-scarce country like South Africa. There is, however, continuing concern from the local regulators regarding the long-term impact that large-scale mine-water irrigation may have on groundwater quality and quantity. Detailed research has been undertaken over the past number of years on both undisturbed soils and in coal-mining spoils. These sites range from sandy soils to very clayey soils. The results indicate that many of the soils have considerable attenuation capacities and that over the period of irrigation, a large proportion of the salts are contained in the upper portions of the unsaturated zones below each irrigation pivot. The volumes and quality of water leaching through to the aquifers have been quantified at each site. From these data mixing ratios were calculated in order to determine the effect of the irrigation water on the underlying aquifers.

One of the outcomes from this study was to define the conditions under which mine-water irrigation can be implemented and the associated operational and monitoring guidelines that should be followed. These have been based on the findings from this study, the fundamental considerations of mine-water irrigation, the regulatory environment and, as far as possible, the practical implementation of mine-water irrigation as part of optimal mine-water management. In an attempt to standardise decision-making regarding mine-water irrigation, the criteria, data, rules and fundamentals discussed have been combined in a user-friendly tool, called GIMI (Groundwater Impacts from Minewater Irrigation). This tool should assist in the practical implementation of mine-water irrigation as part of optimal mine-water management.

**Keywords:** irrigation, coal mine water, monitoring guidelines