

Comparative assessment of widespread irrigation with low quality mine-water in undisturbed and rehabilitated mine-lands in the upper Olifants using the *ACRU2000* model

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Abstract

The *ACRU* agrohydrological model, in the form of *ACRU2000* and its salinity module, *ACRUSalinity*, was employed in catchment-scale assessment of widespread irrigation with low quality mine-water in undisturbed (un-mined) and rehabilitated soils in the Upper Olifants basin of South Africa. The study area comprised a small catchment of 4.7 km² located in a coal-mine environment, known as the Tweefontein Pan catchment. The catchment drained to a surface reservoir (Tweefontein Reservoir) of maximum capacity and surface area 4 000 Ml and 1.5 km², respectively. The catchment was instrumented to measure hydrodynamic responses and simulated as a hydrological system. Consideration was given to runoff, groundwater storage, evapotranspiration, baseflow, interception, irrigation water supply and rainfall, thereby accounting for all the dominant hydrological components of the system. Three scenarios were simulated using the available records for 5 years (1999 to 2004). The first was a baseline scenario representing the prevailing condition in the study area and the other 2 scenarios represented widespread irrigation with the mine-water on undisturbed and rehabilitated soils. In simulating the widespread irrigation on rehabilitated soils, a distinction was made between a rehabilitated irrigated area before and after the re-establishment of the equilibrium water table. Comparison of the results from the simulated scenarios indicated that a greater undisturbed area (max of 160 ha) than rehabilitated area (max of 120 ha) could be irrigated with mine-water from the Tweefontein Reservoir. Irrigation on rehabilitated soils depleted the water in the reservoir more rapidly than irrigation on undisturbed soils, due to lower runoff and higher ingress to groundwater in rehabilitated areas.

Keywords: mine-water, widespread irrigation, mined land irrigation, Upper Olifants, catchment scale, hydrological assessment, *ACRU2000*