

# The hydrodynamic response of a semi-arid headwater wetland to technical rehabilitation interventions

ES Riddell<sup>1\*</sup>, SA Lorentz<sup>1</sup> and DC Kotze<sup>2</sup>

<sup>1</sup> School of Bioresources Engineering and Environmental Hydrology, University of KwaZulu-Natal, Private Bag X01, Scottsville, Pietermaritzburg 3209, South Africa

<sup>2</sup> Centre for Environment and Development, University of KwaZulu-Natal, Private Bag X01, Scottsville, Pietermaritzburg 3209, South Africa

## Abstract

Loss of wetland extent continues to be documented as a significant problem and this is true for the headwaters of the Sand River system in the north-east of South Africa. Here wetlands are undergoing severe down-cutting by erosion gullies (dongas) leading to desiccation of the system and loss of viable substrate that is used for subsistence agriculture. The Manalana sub-catchment was the focus of an integrated wetland rehabilitation programme between 2004-2009, a major focus of which was the stabilisation of such erosion gullies by large retaining structures. This paper presents findings of a hydrological monitoring study of the shallow groundwaters to determine the wetland's hydrodynamic behaviour and the extent to which this had degraded as a result of erosion. Furthermore, whether technical rehabilitation could ameliorate any degradation in the wetland's hydrological condition was also assessed. The findings show that the wetland groundwater hydrology is strongly controlled by the distribution of clays within it, facilitating distinct hydrological micro-regions within the wetland spatially and vertically. Based on these findings it is revealed that the loss of these clays impacts severely on the system's hydrology. The installation of an impermeable buttress weir was able to restore these hydrodynamics as observed through the reversal of the hydraulic gradients between groundwater observation stations, but the precise placement of the structure was shown to be crucial for this effect. This finding demonstrated the requirement of informed, or wise, technical rehabilitation principles based on hydro-geomorphic understanding of the system. A downstream pervious gabion dam was also monitored for its effect on restoring the wetland's hydrology, but observed responses showed little change, and, in fact, the wetlands hydrology here remained intact, attributed to the presence of a clay plug that was saved from erosion by the placement of this structure.

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