IAHS2017-198
IAHS Scientific Assembly 2017

Numerical modelling to study the possible impact of landfill sites on groundwater in Richards Bay and Empangeni, South Africa

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Groundwater modelling is an indispensable tool to understand the changes in flow regime in an aquifer system. The objective of this study is to assess the possible migration pathway of pollutants in groundwater from a landfill sites in Richards Bay and Empangeni, South Africa by numerical modelling. A three dimensional groundwater model was developed using finite element code. The study region consists of two aquifers, an unconfined aquifer of thickness 13-18.5m underlined by a confined aquifer of thickness 10-25m. The hydrogeological parameters like hydraulic conductivity, porosity and groundwater level were derived from previous studies and secondary data. Initially, the model was calibrated in steady-state condition and later in transient-state for the period from 2004 to 2010. Calibrated model was validated with the observed head for the period from 2011 to 2015. Computed head matches reasonably with the observed head. The validated model was run until 2030 to predict the groundwater flow under various scenarios of recharge and pumping. The migration direction and distance of movement of particles from the landfill sites with respect to time was predicted. The particles from the landfill sites move towards east, indicating the possible impact on groundwater quality in the surroundings. This was also verified by collection and analysis of groundwater samples from the wells around the landfills. This study highlights the need for proper management of the landfills to prevent groundwater contamination in surrounding areas.
Keywords: Groundwater modeling, FEFLOW, Landfill sites, Particle tracking.