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Investigation of the impact of recharge water with respect to quality into the Khutala Colliery Rehabilitated block I opencast operation

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ABSTRACT

This study was an investigation of the impact of recharge water with respect to quality and quantity into the Rehabilitated Block I opencast operation, a former opencast coal mine in Mpumalanga, Witbank Coalfields western complex. The rehabilitated areas consisted of three mined mini-pit areas known as Block I, Block I Extension A and B. The area has been rehabilitated by backfilling and leveling of spoil material, subsoil material, placement of approximately 400-mm topsoil layer and grassing. As part of the vegetation maintenance lime is added per annum, in an effort to neutralize the soil cover and further assist in neutralizing the potential acid mine drainage. Additional monitoring boreholes were drilled to increase the monitoring of the water quantity and qualities. Ground and surface water samples were taken, analysed for pH, conductivity, redox potential, sulphates, carbonates and trace metals. The pH of the ground and surface water ranged from moderately acidic to alkaline. One of the monitoring boreholes located on the lowest elevation of the Block I area was observed to be filled up to the collar level of the borehole with water samples showing elevated Fe and Mn concentrations of 216 and 46.2 mg l^{-1} respectively. The water classification revealed the following facies: Ca-Mg sulphate type for the borehole water and Ca-Mg sulphate-bicarbonate type for the surface waters. Acid base accounting studies on the soil samples showed a negative net neutralising potential of up to -9.8 kg t^{-1} $CaCO_3$ which indicated the potential of acid mine drainage in the area. The total metal analyses showed that the area was contaminated with heavy metals such as Fe, Cr, Mn, Ni and Zn and the metalloid As was also detected. The highest recorded concentrations of total metals were 78 252; 2 402; 1 959; 1 360 and 15 109 mg kg^{-1} respectively. The highest concentration of Arsenic was detected at 824 mg kg^{-1} respectively. The transmissivity of the boreholes in the spoil material was highly variable and ranges from 100 to 5 000 m^2 day^{-1}. Pump testing suggests that borehole yields of between 23 and 4 l s^{-1} can be expected in the spoil areas. The specific yield or the drainage porosity of the spoil material was in the range of 25 to 30 %.