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Water footprint for a South African platinum mine

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ABSTRACT

The volume of water consumed by a platinum mine located in South Africa was quantified in two ways: (1) using WaterMiner software to complete the Water Accounting Framework (WAF), and (2) using the Water Footprint Network (WFN) method. The WAF was developed by the Minerals Council of Australia and the Sustainable Minerals Institute at the University of Queensland, and the WFN method was developed by Hoekstra *et al*. (2011). The process steps included in the study were, two concentrator plants, a smelter plant and a tailings dam. The mining step and the external water footprint associated with electricity and chemicals were not included. Flow rate, production rate and rainfall data were obtained from the mining company and average monthly historic evaporation rates was obtained from a South African Department of Water Affairs report (DWAF, 1985). Unknown flow rates around flotation plants, cyclones and thickeners were calculated by closing the mass balance and using densities and percent solids for flows out of this equipment. The measured flow rates, calculated flow rates, rainfall and evaporation data were entered into WaterMiner and the results used to complete the WAF. The measured flow rates, calculated flow rates, rainfall and evaporation data were used to calculate the water footprint for the operation.

When using the WAF, it was found that 12 686 ML/year of water was consumed, while the WFN method showed that 10 649 ML/year of blue water was consumed. The difference in the values calculated was due to the water inputs included in each method. The WAF included water entrained in ore and water obtained from third parties whereas the blue water footprint only included water consumed from surface or ground water sources. The yearly average total water footprint per kilogram of platinum group metal was 806 m^3/kg PGM. Of this, 228 m^3/kg PGM was blue water and 578 m^3/kg PGM was grey water. Concentrator plant 1 had the largest blue water footprint (124 m^3/kg PGM) and the tailings dam the smallest (4 m^3/kg PGM). The largest loss of water was through tailings dam evaporation.

Methods that could be implemented by the mining company to reduce the volume of water consumed on site may include covering the tailings dam to reduce evaporation or to add a pre-concentration step to concentrator plant 2. The blue water footprint can be reduced to 204 m^3/kg PGM (10% reduction) if the tailings dam is covered and evaporation is reduced.

The blue water footprint can be reduced to 216 m^3/kg PGM (5% reduction) if a pre-concentration step is included in concentrator plant 2.