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Guidelines for rainwater harvesting system design for the City of Johannesburg, South Africa

John Ndiritu (1), Adesola Ilemobade (1), and Paulo Kagoda (2)

(1) University of the Witwatersrand, School of Civil and Environmental Engineering, Johannesburg, South Africa (john.ndiritu@wits.ac.za), (2) Sustainable Drop Projects, Pretoria, South Africa (paulo@sustainabledrop.co.za)

The objective of this study was to develop guidelines for the hydrologic design and assessment of rainwater harvesting (RWH) systems in the City of Johannesburg, South Africa. Data for developing the guidelines was obtained from multiple 101 year-long simulations of potential RWH systems in the city. The simulations used daily rainfall from 8 stations and demands based on the probable non-potable uses of RWH systems - toilet flushing, air conditioning and irrigation. The guidelines were also confined to within-year storage behaviour and supply-to-demand ratios ranging from 0.1 to 0.9 were therefore applied. Two generalized design charts of dimensionless relationships were developed. One relates the yield ratio with supply-to-demand ratio and reliability while the other relates the yield ratio with the storage-to-demand ratio and reliability. Reliability was defined as the probability of exceedance of annual yield in order to incorporate the large inter-annual variability of rainfall experienced in the region. The design and analyses of 4 RWH sites within Johannesburg are used to illustrate the application of the design charts. Life cycle costing analysis of these RWH systems is also carried out to assess their financial viability.