



## Groundwater recharge to the Regolith in Uganda

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PROVISION OF A potable water supply for Uganda's predominantly (> 90%) rural population depends upon the development of groundwater. Recent research into the groundwater resources of Apac District in northern Uganda indicates that most groundwater moves by way of shallow weathered soils (regolith) rather than the underlying bedrock fractures which have traditionally been developed (Howard and others, 1994; Callist, T. 1995). Indeed, the Lango people have long relied upon this shallow source through unprotected, spring discharges and hand-dug, "scoop wells". During the last three years, a number of agencies (WATSAN-UNICEF, CPAR) have constructed shallow wells with competent yields in the regolith for domestic, handpump abstraction rates ( $\approx 3\text{m}^3/\text{day}$ ). However, incidents of well failure and waning springflow have been attributed to presumed fluctuations in the shallow water table and raised concerns over the sustainability of groundwater development programmes in this region. Nevertheless, studies of groundwater recharge in Apac have shown that replenishment is in the order of 0.2m/year and occurs exclusively from intense (> 10mm/day) rainfall during the monsoons (Howard and others, 1994). Monitoring of water levels in the unconfined, regolith aquifer was therefore initiated in June, 1994 in order to investigate both the magnitude of water table dynamics in the regolith and the nature of the water table's response to recharge events predicted by developed models of groundwater recharge.

Weekly water levels from the monitoring wells in Apac and Loro are plotted along with weekly volumes of incoming rainfall and estimated recharge in Figure 1. Rainfall and recharge are plotted from January, 1994 while water level records start in June, 1994. Clearly the well hydrographs demonstrate the delayed response of the regolith aquifer to the onset of the rainy season and hence, monsoon-fed recharge. As indicated by the depth to water in each well, the Loro well is situated near a swamp and has a very shallow water table (2.6m). In contrast, the well in Apac is on a plateau, away from swampy areas, with a much deeper water table (9.8m). The Loro well consequently exhibits a sharper response to rainfall-fed recharge in relation to the hydrograph for Apac where recharge events merge over the longer depth to water and produce a smoother profile. These preliminary data also appear to support, by and large, the mag-

nitude of recharge predicted by the soil-moisture balance model (Howard and others, 1994).

Of considerable significance is that the observed water levels appear to confirm the timing and magnitude of predicted groundwater recharge in Apac. The soil moisture balance method of evaluating recharge, and hence, the sustainability of groundwater development programmes, may prove effective in other regions across Uganda and equatorial Africa. The water level data also suggest fluctuations of 0.5m occur in the regolith aquifer. This dynamic may account for the variability in depression-spring discharges which drain the crest of the water table, and should also be considered when positioning screens and gravel packs during shallow well construction. Both assertions are, however, tentative based on the very limited timeframe over which the data have been collected. It is critical that efforts to monitor groundwater levels be continued and extended in order to improve the accuracy, validity and extent of the results.

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### References

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Figure 1. Weekly rainfall, estimated recharge and water-level records from Apac District.  
Presented rainfall, recharge and Apac-D.W.D. records extend up to March 31st, 1995.