

An open source approach on groundwater potential mapping

This Msc Thesis proposes a new approach on rapid ground water potential mapping. The method aims to provide groundwater potential maps, based on free globally available data and open source software. A spatial resolution sufficient to locate areas for the application of geophysics, in order to locate sites for groundwater wells, is required. In the literature few concepts had been found that meets the above stated conditions. Three concepts for watershed and aquifer characterization, as well as the theory of channel head initiation, are introduced and discussed in the first part of this thesis. By combining these concepts from the literature and drainage network extraction from digital elevation models, according to channel heads, a new conceptual approach was established, based on the required applicability with open source software and free data.

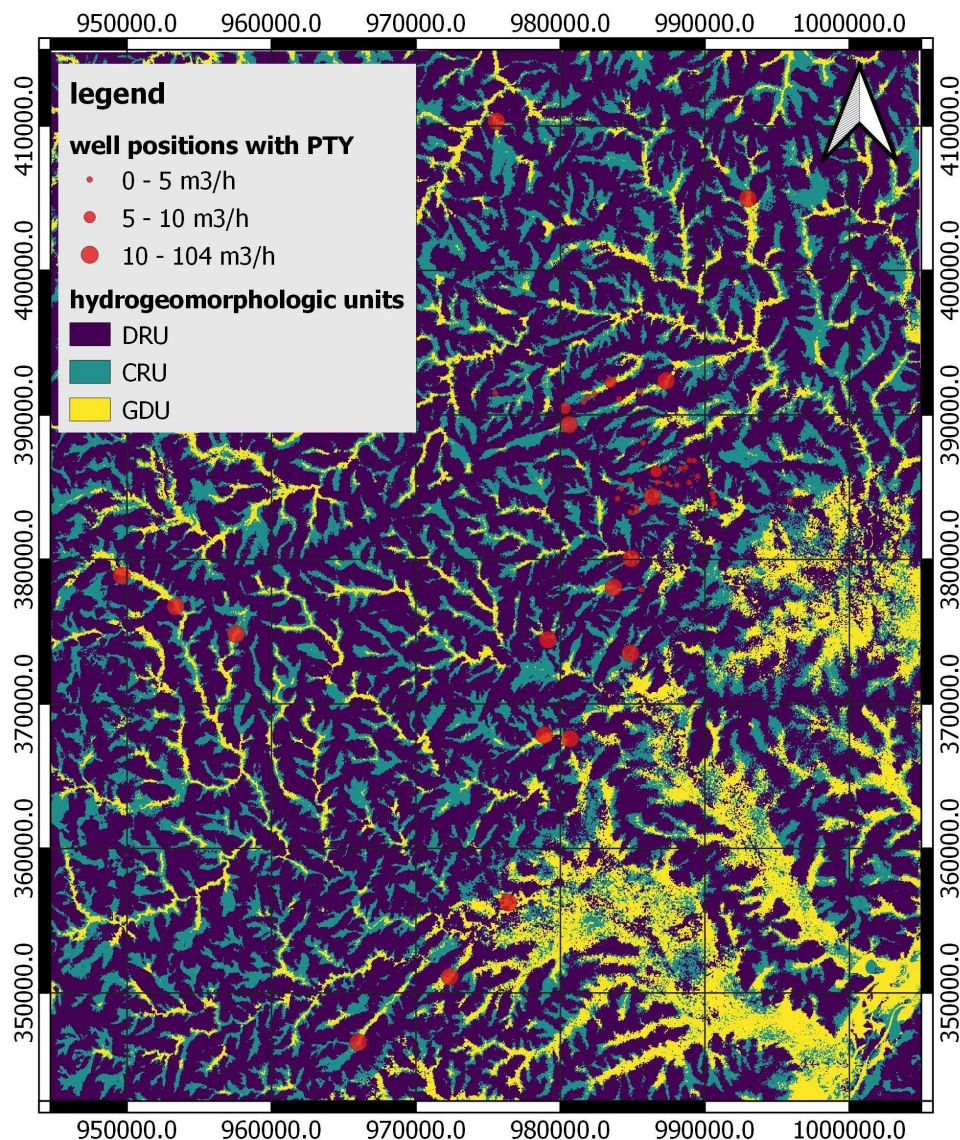


Figure: Hydrogeomorphologic units map of the Bidi Bidi area in northern Uganda, that was made in the course of this master thesis. The red dots indicate locations of boreholes, whose pump test yields (PTY) were used to validate the map.

In order to distinguish areas of different groundwater potential, the land surface is divided into three Hydrogeomorphological Units; the Diffuse Recharge Unit (DRU), dominated by chemical and physical weathering, having no stable surface runoff and mainly diffuse recharge; the Concentrated Recharge Unit (CRU), where physical weathering is dominant, streams initiate and recharge is concentrated; the Groundwater Discharge Unit (GDU) where little weathering happens, but sediments are deposited, natural watercourses meander and are typically in contact with groundwater. An evaluation of the methods capabilities is done by the analysis and comparison of two Hydrogeomorphologic Units maps with local well yield data, one in northern Uganda and one in Switzerland. A correlation between high yielding wells and the groundwater discharge unit could be shown. However the method tends to overestimate areas of high groundwater potential, due to a bias regarding hydraulic conductivity. The presented method can be executed by the use of free open source software and the required data is limited to real color satellite images and 1 arc-second resolution digital elevation models.