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Vulnerability Assessment of Shallow Aquifers in Abuja using GIS and Hydrogeological Parameters

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One of the major challenges for the sustainable development of the federal capital territory of Abuja (Nigeria) is related to the access to safe fresh water resources. This area lies within the drought prone parts of the Sahel region. As in many regions of the world there has been growing competing demands for fresh water as a result of population growth and groundwater quality degradation. In this context, the paucity of data and in depth knowledge of aquifer features and groundwater flow makes groundwater management even more complex, with a severe impact on access to safe water resources for the local populations. To address this challenge, the purpose of the presented research is to generate information on aquifer settings and its vulnerability and on the qualitative and quantitative assessment of the available groundwater resources. Remote sensing and GIS were applied to improve the available information on groundwater resources of Abuja. Fundamental information such as recharge rate, availability and vulnerability of groundwater to pollution was determined. Aquifer vulnerability zones were delineated using the DRASTIC model by integrating layers of depth to groundwater, aquifer recharge, aquifer media, soil type, topography, impact of vadose zone and hydraulic conductivity. The study area covers about 8000km². The elevation ranges from 62 to 843m a.s.l. with the highest elevations at the North Eastern parts and the lowest elevations at the South Western parts of the study area. There are three soil types in the area, the silty clay, silt loam and clay with clay being the predominant soil type. The five major rock types in the area include migmatite gneiss, schist and metasediment, sandstone and river alluvium, granite and quartzite. The aquifer type is phreatic and the depth to groundwater ranges from 2.8 to 21.9 m. The high recharge areas occurred mostly in highly fractured areas covered with metasedimentary rocks, migmatite gneiss and sandstones. The groundwater vulnerability zones in the study area were grouped into four classes: High, moderate, low and very low. The highly vulnerable zones are the North Eastern parts of the study area covering most parts of Bwari and parts of the municipal council areas and also the Southern parts of the study area covering parts of Kuje and Abaji. They constitute the highly fractured areas covered with silt loam soil type. The very low vulnerable zones are the North Western and Central parts covering mostly Gwgalada and Kwali areas. This study demonstrates that GIS and remote sensing techniques are efficient and cost effective tool for delineation of groundwater vulnerability zones. The information obtained will be used as a basis for a geochemical characterization of groundwater quality in the region with the overall goal of supporting new groundwater

management plans in the region.