

Analysis of karst aquifer productivity and its relation to influence radius in the tubular wells of the karstic region APA Carste de Lagoa Santa – Minas Gerais - Brazil

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Located 35km north of Belo Horizonte and with 500 km², the area of study encompasses completely the Environmental Protection Area (APA) Carste de Lagoa Santa and surroundings. This region contains part of the Belo Horizonte Metropolitan Region (RMBH) and partly or totally the municipalities of Lagoa Santa, Confins, Pedro Leopoldo, Matozinhos, Vespasiano, Funilândia and Prudente de Morais. The objective of this study is to analyze the relation between influence radius of tubular wells and productivity, as well as correlate the results with structural directions with higher favorability of water production. Geologically, the region is constituted mainly of mud and carbonatic rocks from the base of Bambuí Group, represented by Sete Lagoas Formation, which is subdivided in two Members: Pedro Leopoldo, at the base, contains impure carbonatic rocks; and Lagoa Santa, at the top, constituted by high-purity calcitic limestones. These carbonates, focus of the study, lie above granite-gnaiss-migmatitic rocks of Belo Horizonte Complex and beneath locally distributed Cenozoic covers. The area's hydrogeology is divided in four units: the crystalline rocks' fissured aquifer; the Sete Lagoas' karstic-fissured aquifer, where the superior member is more karstified and productive; the Serra de Santa Helena's aquitard; and the Cenozoic covers' granular aquifer. Data from 150 tubular wells was used, obtained with the Groundwater System of Information (SIAGAS), Basic Sanitation Company of Minas Gerais (COPASA), Water Management Institute of Minas Gerais (IGAM) and Environment Regional Superintendence (SUPRAM). This data was statistically handled regarding specific storage and influence radius (calculated through Theis Equations, using discharge, water level and local average hydrodynamic factors values). Afterwards, the productivity was compared to negative geomorphologic lineaments, which were grouped in sub-collateral intervals. As expected from a karstic fissured system, the results of mean and median indicated high anisotropy, showing specific storage ranging from lower than 0,5 m³/h/m to superior than 50 m³/h/m. Nonetheless, when these values were grouped into seven intervals, with minimum 9 and maximum 42 wells, the variation of mean and median was almost null, showing a gaussian distribution and homogeneity. That indicates similarities in the dissolution process in these production intervals. The influence radii were grouped in five intervals, ranging from smaller than 50 meters to bigger than 500 meters, with minimum 13 and maximum 47 wells. The result showed an inverse proportional relation between productivity and radius size. Regarding productivity and lineament direction, evidence of groundwater flow for the intervals NE-ENE and ENE-E was observed. Therefore, the conclusions are that although the analyzed karst system has high anisotropy, its dissolution structures with water capable of being transmitted and stored showed high similarity, revealing a developed karstic system. The first order productivity direction is coincident with the flow direction, highlighting the karst development in the study area.

Keyword: Influence radius, Lineaments, Productivity