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Groundwater criteria for the application of the Sponge City concept in wet climate

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Over the past few years, China has promoted the application of the “sponge city concept“ to mitigate the flood risk of the southern sector and alleviate the chronic water scarcity of the northern. Sponge cities consist of LID (Low Impact Development) elements such as permeable pavements and draining swales that directly recharge the urban aquifers. Our study identifies groundwater criteria to maximize the aquifer recharge, based on a combined hydrogeological, geomorphological and hydraulic approach. Our criteria were calibrated on Shenzhen, a Chinese megacity of 20 million of inhabitants of southern China, located alongside the populous Pearl River Delta, with an average precipitation of 2000 mm/y. Shenzhen comprises several urbanized river valleys and coastal plains, surrounded by steep mountains. In the last forty years, Shenzhen underwent a drastic change as urban areas increased from 8 % to 42 % of its extent. The current Shenzhen sponge city plan is based on socio-economic and ecologic criteria and unfortunately hydrogeological aspects have been neglected. Via field activities, analysis of borehole stratigraphies and collection of water levels on piezometers, aquifers were classified based on their capacity to absorb the rainfall. Though aquifer characteristics are similar throughout the study area, piedmont sectors have outstanding absorption capacity. On the contrary, alluvial valleys and coastal areas have groundwater levels near or coincident with ground level and quickly saturate during the wet season. Results do not match with the current “sponge city plan“. Hydrogeological criteria must be considered in the current policy, to better mitigate the flood risk in the area. At the same time, rural piedmonts must be protected from the unrestrained urbanization that characterized the Shenzhen megacity in the last decades.