

Water clogging in arid urban areas, causes, solutions and opportunities for sustainable utilization

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Water table rise (WTR), also known as water clogging, is a serious phenomenon observed in a number of urban areas around the world. It has imposed environmental threats and put public health under risk. WTR endangers the stability and challenges the establishment of engineering structures. WTR occurs in many arid areas lacking stormwater infrastructure several areas in Muscat, Oman where shallow water has appeared in excavations or at low-lying areas. In this research, we have utilized hydrochemical, isotopic and biological analyses to understand the causes of WTR in Muscat. The analyzed samples were collected from groundwater, surface water, sewage system and public network. The chemical analysis of water samples reveals elevated concentration of Ca, Mg, SO₄ and Cl ions resulting from carbonate and evaporitic dissolution. This dissolution caused a regional and natural increase of salinity in the area. However, local pockets of low salinity are found aligned with Public Network (PN) infrastructure, and suggest leak from PN and therefore dilution. Biological analysis shows limited presence of E. Coli encountered only in surface water which eliminates the possibility of septic tanks leak. Water classification based on deuterium and oxygen-18 isotopes analysis shows three groups of water: 1- depleted groundwater recharged from prolonged heavy showers and does not interact with public network. 2- Water with isotopic signature clustering around zero suggests mixing with public network, and 3- isotopically enriched water subject to evaporation and is located either on ground surface or at shallower depths. High resolution long-term piezometric records have shown groundwater level fluctuations in response to precipitation and climatic variations. These records along with the isotopic, biological and chemical analyses indicate that WTR is aggravated by localized leak from PN while it is a natural regional phenomenon induced by urbanization. Proper planning that involves better coordination between authorities for future urban developments will tackle urbanization induced WTR. Recommended solutions to alleviate the problem include: digging temporary trenches, improve the public water network infrastructure, monitoring and testing, design and install stormwater drainage, use shallow water for different purposes (e.g. recreational areas, construction, irrigation of gardens etc).

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