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The role of hydrogeological and contamination sources inventories in groundwater management: Porto City (NW Portugal)

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The increased development of urban areas poses a threat to the quality and quantity of groundwater. Porto City is a densely urbanized region dominated by granites, which constitute an anisotropic and heterogeneous fractured media. These granites constitute the main groundwater systems and these groundwaters represent a major factor for the development of Porto City throughout the last six centuries (e.g., Carteado Mena [1], Afonso et al. [2], Freitas et al. [3], Chaminé et al. [4]). The main target of this work was to highlight the importance of hydrogeological mapping, as well as the vital significance of hydrogeological and potential contamination sources inventories to understand the vulnerability of Porto City groundwater systems. This study was developed in two drainage basins, Asprela and Massarelos, located, respectively, in the North and South of Porto City. An extensive groundwater inventory and also an inventory of potential contamination activities were documented in these areas. This study was supported by GIS technology, which was fundamental to a better understanding and integration over the study areas. Previously to the inventory implementation, a characterization of the drainage basins, regarding their geography, geology, hydroclimatology, land use, geomorphology and hydrogeology, was performed. Concerning land use, both drainage basins are mainly developed in the urban fabric. Regarding geomorphology, the two drainage basins are embedded in fracture valleys and flattened areas are dominant, with altitudes ranging from 80 to 125 m. Both drainage basins are developed mostly in the hydrogeological unit characterized by granite, medium to fine grained, sometimes with saprolite extensions. The hydrogeological inventory included 29 water points, mostly springs and fountains, in Asprela and Massarelos drainage basins. Groundwaters are colourless, with no turbidity and no smell, have low temperatures (*ca.* 15-17°C), are acidic (pH *ca.* 5-6), with low to medium mineralizations (electrical conductivities > 400 µS/cm), and very low yields (< 0.1 L/s). Concerning potential contamination sources, 139 activities were recognised in Asprela and Massarelos drainage basins. Most of these activities are of point source character, namely school buildings and gas station/garages. Nevertheless, line sources have a significant spreading through both drainage basins, specially the water supply system and the sewage network. Although the intrinsic vulnerability to groundwater contamination, evaluated by the GOD-S and DRASTIC indexes, is low to moderate in these areas, the location of the potential contamination sources may enhance the vulnerability in these drainage basins. This methodology demonstrated valuable in further broadening our knowledge of Porto City groundwater systems and also the hydrogeology in urban areas.

References:

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