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Modeling of sewer network impacts on urban groundwater

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Urbanization results in various impacts on groundwater : modification of the natural recharge due to imperviousness, complexity of the soil water flowpaths, temporary and permanent drawdown of piezometric level, leakage from buried networks (Lerner, 2002). Consequently, a detailed modeling of hydrological cycle in urban areas makes it necessary to consider the interaction of groundwater with buried equipments (Rodriguez et al., 2008). The present study deals with the groundwater drainage by the trenches and pipes of buried networks sewer pipes. The case study consists in an urban catchment located in the city of Nantes (France) , with a surface of 30 ha where a complete experimental hydrologic monitoring is realized (rainfall, discharge, piezometric levels, meteorological parameters Ĕ). A geological analysis of this site enabled to define geological and hydrodynamic parameters. An elementary object of urban soil has been defined in order to implement this study. This object represents a 3D element of 100m by 100m centred on a trench containing a sewer pipe, along with the near subsurface and ground soil. Three soil layers were defined in this object, one of them allowing the insertion of sewer and trenches. This study is focused on the hydrological modelling of this elementary object, in order to evaluate its ability to represent the groundwater drainage of sewer trenches. The 3D hydrodynamic code of groundwater modeling Modflow (U.S. Geological Survey) was used. Preliminary tests were realized in order to evaluate the impact of upstream and downstream boundary conditions and to determine the appropriate cell size. Three options were tested to represent sewer trenches : 1) modify the hydrodynamic parameters of a small cell, both the trench and the sewer network having the same parameters, 2) assume that a sewer pipe is similar to a farming drainage system, 3) assimilate the sewer to a river, considering that water

exchanges between sewer and soil are strictly verticals. Only options 1) and 2) were kept in this part of this study. The simulation of the elementary modeling object was first realized in steady state. A sensitivity study has been done to analyze the effect of the trench position in the object (the trench may be either parallel or perpendicular to the main flux) (Adamiade, 2004). The model was then executed with a typical area recharge of 700 mm/yr and we have analyzed the model reaction confronted with three different precipitations.

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