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Assessing Heterogeneity in Flow and Transport Processes at the Groundwater-Surface Water Interface and Their Role in the Degradation of Organic Contaminants

U. Schneidewind (1,2), I. Joris (1), O. Batelaan (4), M. Schirmer (5), P. Seuntjens (1,2,3)

(1) VITO – Flemish Institute for Technological Research, Environmental Modeling Unit, Boeretang 200, 2400 Mol, Belgium, uwe.schneidewind@vito.be , (2) Ghent University, Department of Soil Management, Coupure links 653, 9000 Gent, Belgium, (3) University of Antwerp, Department of Bioscience Engineering, Groenenborgerlaan 171, 2020 Antwerpen, Belgium, (4) VUB - Vrije Universiteit Brussel, Department of Hydrology and Hydraulic Engineering, Pleinlaan 2, 1050 Brussels, Belgium, (5) EAWAG, Department of Water Resources and Drinking Water, Ueberlandstrasse 133, 8600 Duebendorf, Switzerland

With the adoption of the EU Water Framework Directive participating member states have agreed on a set of goals to be reached by 2015, which includes improving groundwater quality, reducing the pollution of water bodies and protecting aquatic and adjacent terrestrial ecosystems alike. Recent research has shown that it is beneficial to consider groundwater and surface water bodies as part of a coupled system where aquifer and river are connected by the groundwater-surface water interface or hyporheic zone. Due to its biochemical characteristics, this zone often plays an important role in the attenuation of contaminants. As in aquifers, flow and transport processes in the hyporheic zone strongly depend on heterogeneity in flow and transport parameters. As such, an analysis of these heterogeneities is necessary to improve modeling results and reduce epistemic uncertainties. The following study focuses on assessing heterogeneity in flow and transport processes while looking at the natural attenuation of organic contaminants within the hyporheic zone. It is part of the ADVOCATE program (Advancing Sustainable In Situ Remediation for Contaminated Land and Groundwater), an EU FP-7 program aimed at integrating various scientific, technical, environmental and socio-economic aspects affecting decision-making, management strategies and technology applications for contaminated land and groundwater across different scales. Heterogeneity in flow and transport processes is addressed by looking at hydraulic conductivity and reaction rates, two of the most influential parameters in contaminant attenuation processes. A stochastic modeling approach is used to account for their spatial variability. Field data on hydraulic conductivity and reaction rates is gathered from the Vilvoorde-Machelen Site North of Brussels. At this area with more than 100 years of industrial history a plume containing mainly CAH is flowing towards the River Zenne, a mostly gaining and partly regulated lowland river with a riverbed containing sands, slick and gravels. Results will help to validate conceptual models regarding natural attenuation of organic contaminants in the hyporheic zone and identify how heterogeneity influences the prediction of natural attenuation.