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Recommendations of suitable urban storm water infiltration devices for different runoff types under varying hydrogeological conditions

P. Göbel (1), J. Zimmermann (1), C. Klinger (2), H. Stubbe (2), W.G. Coldewey (1)

(1) Division of Applied Geology, Germany, University of Münster (angeo@uni-muenster.de / Phone: +49-251-8333941) (2) Deutsche Montan Technologie GmbH, Germany (holger.stubbe@dmt.de, christoph.klinger@dmt.de / Phone: +49-201-1721862)

The decentralized infiltration of storm water in residential areas can cause a local impact of pollutants into soil, seepage water and ground water. Heavy metals (e.g. Pb, Zn, Cu), polycyclic aromatic hydrocarbons (PAH), petroleum hydrocarbons and readily soluble salts in the runoff are partly classified as hazardous to water. The distribution or content of these pollutants depends on the characteristics of the surface (kind of building material, road runoff, roof runoff), and the dry and wet atmospheric depositions. Infiltration of storm water can cause increasing concentrations of the pollutants in the soil or infiltration system at first. Although soils and the materials in infiltration devices are able to retain most of the pollutants input by filtration, physicochemical processes and biological degradation, the capacity is limited in some materials, in this regard. So in the long term a migration through the unsaturated zone to ground water is possible. Therefore, the infiltration of storm water over a long period means a potential hazard to soil, seepage water and ground water.

The qualitative effects of storm water infiltration on soil, seepage water and ground water are investigated with long term numerical modelling over 50 years. The retention behaviour of different soils and materials used in infiltration devices is determined with batch and column tests. Results of the laboratory tests are adsorption isotherms which represent input data for numerical transport modelling. The long term simulations are performed with combinations of different runoff types and infiltration devices (swale and trench with three different trench materials) under different hydrogeological conditions (high adsorbing soil with low permeability, low adsorbing soil with

high permeability). The examined runoff types are subdivided as follows: runoff of

- unpaved areas (gardens, grassed areas, cultivated land),
- green roofs,
- aluminum roofs
- roofs without zinc gutters and downpipes
- roofs with zinc gutters and downpipes,
- copper roofs,
- zinc roofs and
- road surfaces (cycle and pedestrian ways, yards, car parks and residential streets).

The main objective of this research project is to work out recommendations of suitable infiltration devices for eight different runoff types. In Germany critical values regarding soil and infiltration water are given by the German Federal Soil Protection Act and Ordinance (BBodSchG, 1998; BBodSchV, 1999), by the German Länder Working Group on Waste (LAGA 2004) and by other literary sources. Simulation results of 50 combinations are compared with these critical values. The hazard potential in the resultant assessment matrix are graded in four hazard levels regarding the impact on soil (first 20 cm of the soil), seepage water (1 m below the infiltration device) and ground water (unsaturated-saturated boundary).