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Hydrological functioning of an innovative planted filter for runoff water depollution

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Urban stormwater management is a major challenge for limiting the degradation of surface aquatic environments. Given the limitations of traditional sewer systems, nature-based solutions are now being implemented at various scales to control the pollutants generated by runoff during rain events. Two main families of solutions can be distinguished: 'decentralised' systems, aimed at limiting runoff at source, and 'centralised' systems, aimed at storing or treating volumes associated with catchment areas of several hectares, potentially mixing rainwater and wastewater. While the first type of solution should be more advantageous, the second is no less relevant, particularly in constrained urban contexts where the scope for building new facilities is limited.

In this context, the City of Paris set up an experiment involving an innovative centralised system based on the planted filter concept. The main goal of this project is to evaluate the efficiency of this system to reduce the pollutant loadings of stormwater runoff. Mineral and organic micro-pollutants are specially investigated with a focus on the dissolved phase that is not sufficiently taken into account in the classic depollution systems of rainwater. In order to compare the innovative filter to a "classic" planted filter, two filters were built.

The two filters have an area of 600m². The classical one consists of, from the bottom to the top: 30cm of gravel 20/40 within which drains are installed, 20cm of gravel 8/20, 10 cm of gravel 4/8 containing aeration network and the filtration layer composed of 40 cm of sand 0/4. The innovative filter only differs by the 40-cm filtration layer which consists of 10cm of sand 0/4, 20 cm of Rainclean® (Funke Kunststoffe GmbH, Hamm, Germany) and 10cm of sand 0/4. Rainclean® was specially selected during the preliminary design studies to optimise the treatment of dissolved organic and metallic micropollutants. It has never been tested before in planted filters.

Filters receive runoff waters coming from 21ha of the ring road of the city of Paris (1.3 million vehicles/day) but also clear water during dry weather.

Since the beginning of the experiment (in May, 2021), each filter received about 56 m and 90 m of water during rain events and dry weather respectively. These large volumes of clear water could affect the pollution reduction efficiency of the filters with faster exhaustion of the filter media. However this impact still has to be clarified.

More generally, an assessment of the current functioning of the filters is still necessary. To do so,

water sampling to estimate the capacity of the filters to reduce pollution is undergoing.