	Suivi expérimental de deux ouvrages de filtration végétalisés à Compans **Livrable final** Kelsey Flanagan, Philippe Branchu et Marie-Christine Gromaire	

SYNTHESIS OF RESULTS FROM MONITORING THE COMPANS STUDY SITE (VEGETATIVE FILTER STRIP AND BIOFILTRATION SWALE)

- ABSTRACT

This result is focused on the *in-situ* monitoring of a wide range of micropolltuants typical of road runoff (trace metals, total petroleum hydrocarbons, polycyclic aromatic hydrocarbons or PAHs, alkylphénols, bisphenol-A and phtalates) and global water quality parameters in two biofiltration systems located beside a highway: a vegetative filter strip and a biofiltration swale. This field work involves continuous flow and water quality measurements, the sampling and analysis of runoff and water treated by both systems (nineteen rain events over a year-and-a-half period) as well as the sampling and analysis of soil. This work is combined with a laboratory characterization of the filter media and biofilter construction materials and a stochastic modeling approach used to evaluate the annual mass balance of pollutants in the biofiltration swale.

Field results highlight the capability of this type of system to significantly reduce total concentrations of micropollutants at the event scale. Treatment is particularly effective for contaminants mainly associated with suspended solids, such as zinc, lead and PAHs, for which median concentration reductions exceeded 90% in both systems. Median concentration reductions observed for copper, chromium, nickel and octylphenol are also quite good, exceeding 70%. Treatment efficiency is lower and more variable for the other organic micropollutants.

Three events, characterized by a degraded performance with respect to suspended solids and particulate pollutants, are nevertheless observed during a winter period when deicing salt was applied to road surfaces. The comparison of particle composition between road runoff and treated water indicates that this behavior was not due to particle erosions but rather the poor filtration of road-originated particles. The poor retention of particles is probably due to an exceptional abundance of fine particles (<10 µm) in the road runoff during this period, in combination with the formation of preferential flows in the filter media due to cracking.

The retention of dissolved-phase micropollutants is generally less effective than that of the particulate phase; in particular, elevated dissolved concentrations of several micropollutants (bisphenol-A, alkylphenols, phthalates) were observed during the first months of operation of the biofiltration swale.

The transport of dissolved trace metals appears to be facilitated by their association with dissolved organic carbon. These contaminants may also be leached from contaminated soil and road sediments. The retention of dissolved organic micropollutants is essentially limited by the contamination of the filter media, which predates installation in the biofilter for PAHs and is attributed to pollutant emissions from construction materials for BPA, OP, NP and DEHP.

In order to better understand the system's ability to reduce pollutant loads and to characterize the fate of pollutants in the filter media, a mass balance is evaluated at the annual scale for a selection of the studied pollutants. This work, which combines experimental results with a stochastic modeling approach, reveals that the reduction of pollutant loads is generally lower than the median concentration reduction observed at the event scale due to the frequent overflow of water from the device. It also shows the significance of organic micropollutant emissions from biofiltration swale construction materials, which were much greater than the pollutant loads intercepted over the first year of operation.

Overall, this work demonstrates the interest of biofiltration systems as an approach for the management of pollutant loads associated with road runoff but also reveals the need to produce and distribute guidelines for the design and maintenance of such systems. Additionally, it brings to light various methodological difficulties associated with evaluating the water quality performance of this type of system and highlights the importance of developing a perennial observatory of a biofiltration device dedicated to and designed for long-term monitoring.

- KEY WORDS : urban stormwater, road runoff, micropollutants, sustainable urban drainage systems, swale, biofiltration, vegetative filter strip, soil, Ile-de-France, metals, polycyclic aromatic hydrocarbons, phthalates, alkylphenols, bisphenol-A