Perspective
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India's Urban Drainage Systems: Control and Green Technologies

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Perspective

On the one hand, the increase in waterproof surfaces, a common urban phenomenon, reduces the volume of rainwater that naturally infiltrates the subsoil; on the other hand, it determines the increase in speeds, flow rates, and outflow volume surface; and, at the same time, it causes a qualitative deterioration of the water. This study looked into the best way to manage urban drainage systems by combining real-time control with green technologies. The Environmental Protection Agency (EPA) Storm Water Management Model (SWMM) was used to create a hydraulic model of the sewer system in the suburbs of Bologna (Italy) in order to assess the reduction in water volume and the amount of pollutants released in water bodies. The combination of these technologies allows for large reductions in both pollutants released into receiving water bodies and overflow volumes, while also improving treatment plant operation. Green technologies result in a 45 percent reduction in volume and a 53 present reduction in total suspended solids (TSS) supplied to the receiver. The modelled scenarios reflect only a small portion of the conceivable configurations for urban drainage systems; combining multiple methods could result in even better drainage system performance.

In light of numerous studies demonstrating an increase in the frequency of extreme precipitation and floods, as well as soil sealing, as a result of urbanisation across Europe, storm water management is playing an increasingly important role in the protection of urban catchments from two undesirable phenomena: I pluvial floods and (ii) combined sewer overflows (CSOs). Engineers should develop ways to reduce the detrimental impact of these phenomena on human life, economic assets, and the environment, while also considering sustainability. Green roofs, bio swales, rain gardens, permeable pavements, vegetated strips, wet/dry ponds, and other techniques are examples. Rainwater harvesting systems are another type of SCT. Despite being designed to address other objectives such as reducing water withdrawal from traditional sources or encouraging water conservation in buildings, they minimise and delay the peak of runoff delivered into sewer systems, so helping to CSO reduction. The possibility of examining the impact of a complementary use of EOPSs, SCTs, and RTC in terms of reducing the volumes of water and masses of pollutants discharged by CSOs, as well as urban flooding, cannot be overlooked in the optimal management of a modern urban drainage system. To overcome the aforementioned information gap, a scenario-based method was used to investigate the long-term behaviour of a small urban catchment (48 ha). The Storm Water Management Model of the Environmental Protection Agency (EPA) was used to model the quantity and quality of runoff (SWMM) This research developed and demonstrated a modelling method for evaluating the effects of installing EOPSs, various types of SCTs, and RTC to reduce the volume and TSS mass poured into the receiving body during CSO events. The case study focused on a small catchment in the city of Bologna's early suburbs (Italy). Different technologies, such as green roofs, permeable pavements, rainwater harvesting tanks, and detention tanks with and without RTC systems, were inserted into a numerical model of the drainage system that was calibrated and validated based on experimental measures for both water quality and quantity.

As a result, 12 different situations emerged. Continuous simulations were run using 15 years of precipitation and temperature data as input. The model was proved to be a good tool for assessing these technologies' long-term behaviour. The use of long series of precipitation and temperature data, in particular, permitted simulations of genuine reservoir filling and emptying cycles, as well as evapotranspiration phenomena, which have a significant impact on the behaviour of technologies with vegetation. In general, all systems performed admirably in terms of reducing volume and TSS mass.

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