



## **The role of antecedent conditions on nature based measure functioning in managing peri-urban storm runoff**

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Many regions across the world face increasing pressures of managing flood risk whilst accommodating expanding (peri)urban development alongside increases in intensively farmed landscapes. Urbanisation and agriculture bring numerous environmental pressures, for example soil sealing and increased connectivity to channels, which contribute to flooding. Nature-Based Solutions (NBS) are promoted as cost-effective catchment wide approaches to water management, providing benefits to flood risk management whilst delivering other ecosystem services. While efficient NBS offer benefits to both urban and rural systems, there is a need to understand underlying hydrological controls including the role of antecedent conditions on how these measures perform in complex peri-urban landscapes to inform future catchment planning.

This research explores storm runoff generation characteristics in several UK actively urbanising catchments and assesses the functioning of selected NBS measures for managing storm runoff in contrasting landscapes (intensive farmland and new urban developments). We focus on interventions detaining storm flows such as raised bunds and so-called sustainable drainage approaches (SuDs). Our focus research catchment (55km<sup>2</sup>) has rural headwaters, mixed (urbanising) land use in the central part and an urban zone concentrated in the lower catchment area. Here, storm hydrographs were analysed from six multi-scale gauging stations over a five year period. Water level data were analysed from both rural and urban NBS measures linking response rates to antecedent conditions for various storm types.

Findings suggest three distinctly different patterns in the timing and magnitude of the contributions of the different land-use zones and their nested integrated runoff response at increasing scales. These can be clearly linked to variations in antecedent conditions and precipitation patterns and intensities. Low antecedent conditions also play a vital role in rural measure functioning with measures filling to lower levels, notably during intensive storm events (compared to urban measures). These findings, supported by data from other case study sites, highlight the need for both connectivity and soil management at source in peri-urban landscapes to manage catchment wide flood risk. Further work is also needed to integrate stakeholder engagement and delivery (funding) mechanisms for NBS approaches in both rural (e.g. delivery via agri-environment payments) and urban (e.g. delivery via planning and development processes) landscapes in order to deliver fully a cost effective catchment wide plan.