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Hydraulic performance of bio-swales in polder conditions, a field survey

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More extreme rainfall events and droughts are expected to occur in the future due to climate change, in addition to a continuing urbanisation. City's need to prepare for this, and become more climate resilient. To contribute to this goal, the city of Rotterdam wishes to disconnect as much stormwater as possible from the sewer-system. This can be done by means of SUDS's (Sustainable Urban Drainage Systems), which (temporarily) store the water and by doing so contribute to restoring the city's natural water system. Within the project Water Sensitive Rotterdam, information has been gathered on these SUDS's to contribute to standard designs which can be used in the whole of Rotterdam. One promising solution is the bioswale, also known as a bioretention swale or wadi. Stormwater from streets and roofs is conveyed to the swale, in which the water gathers and ponds. The water then infiltrates slowly into the soil, excess water can be drained by the underlying drainage pipe.
The bioswale should be able to function throughout the Rotterdam urban region and as such be capable of dealing with high groundwater (often with precipitating iron salts) and low permeability soils (clay and peat). Though bioswales have been applied in The Netherlands since 1996, limited research has been done on actual field performance. This is critical to better link design, properties of the area and weather conditions with the observed hydraulic performance. In this study, controlled field experiments have been conducted in 5 existing bio-swales (2-5 years old) in Rotterdam. Their hydraulic performance will be tested by filling them 4 times each, simulating 4 different weather-scenarios. These conditions are respectively a heavy storm (completely filling the bioswale) in dry conditions, a heavy storm in wet conditions, a two-peak storm and a moderate storm (partly filling the bioswale). The following criteria will be used to assess performance of the bioswales: peak delay, peak reduction, delayed volume, volume reduction and emptying time. This will be done by measuring the water levels in the bio-swales and discharge from the drains. The groundwater table is monitored below the wadi, in order to determine whether the permeability of the soil or de drain governs the infiltration. In addition, the groundwater is monitored at various distances from the wadi, to determine the influence (range) of the infiltrating water on the groundwater table.
Measurements will start mid-January and are expected to end mid-March 2019. We will present results of the field monitoring and compare these to simulation results (Hydrus-2D) to evaluate how well the model can predict the behaviour of the bioswales.